MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 35 JUNE, 1929 Number 10

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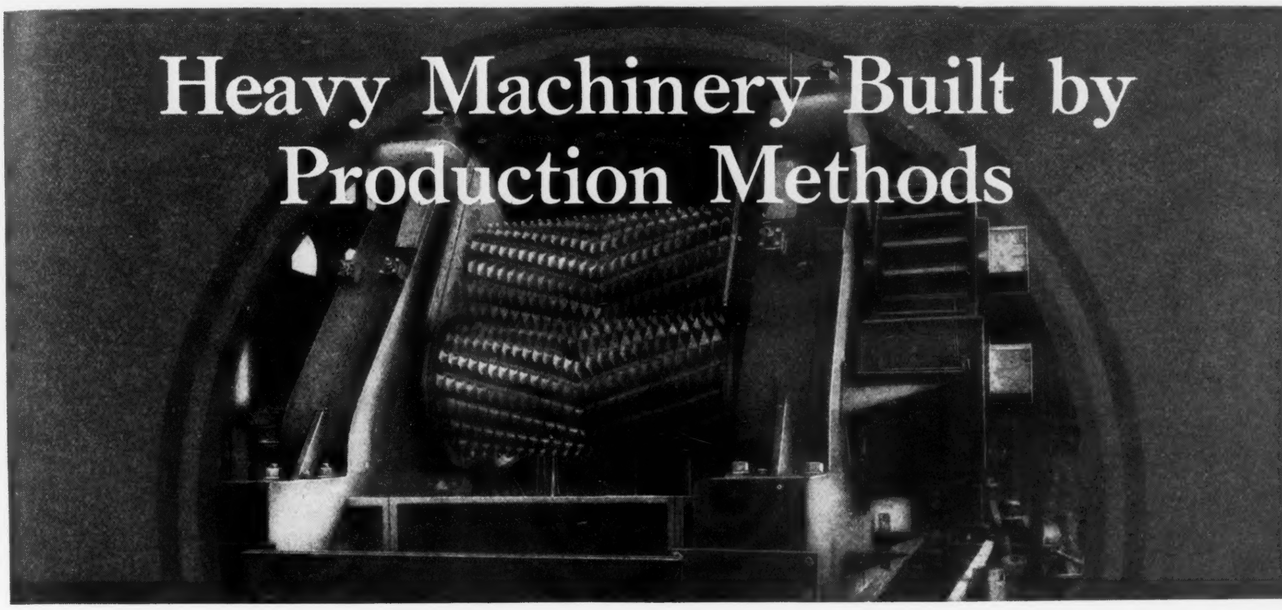
MACHINERY

Volume 35 NEW YORK, JUNE, 1929 Number 10

Heavy Machinery Built by Production Methods



Operations of Unusual Interest Employed in the Construction of Machinery Used in Extracting the Juice from Sugar Cane

By CHARLES O. HERB

MORE than five thousand tons of sugar cane are crushed per working day of twenty-four hours in modern sugar mills which automatically carry the stalks of cane through a series of rolling operations until the juice is thoroughly extracted. Such sugar mills are composed primarily of one pair of crusher rolls of the type shown in the heading illustration and in Fig. 4, and six or seven sets of mill rolls of the general design shown in Fig. 5. There are three rolls in each set of mill rolls, which makes a total of twenty to twenty-three rolls in tandem. Sugar cane is brought to the mills from plantations in railway cars carrying about thirty tons of cane each. From these cars, the cane is dumped on a carrier, which automatically conveys it to the crusher rolls and then through the mill rolls. The fine bagasse, or refuse, delivered by the final rolls is used for fuel without drying. The center-to-center distance between the sets of rolls is usually about 20 feet, and the conveyor extends between them.

From the illustrations referred to, it will be seen that both the crusher and mill rolls have opposed helical grooves of long lead which extend from the ends to the middle of the rolls. These grooves are planed completely around the rolls in one setting, at the end of which the rolls resemble herringbone gears. Annular V-grooves are later machined around the entire length. These combined herringbone and annular grooves draw the cane between the rolls and reduce it to pulp. It will be seen that the annular grooves of the primary mill roll illustrated in Fig. 5 are much smaller in pitch and less in depth than those of the crusher rolls, and the grooves of the succeeding mill rolls decrease gradually in size.

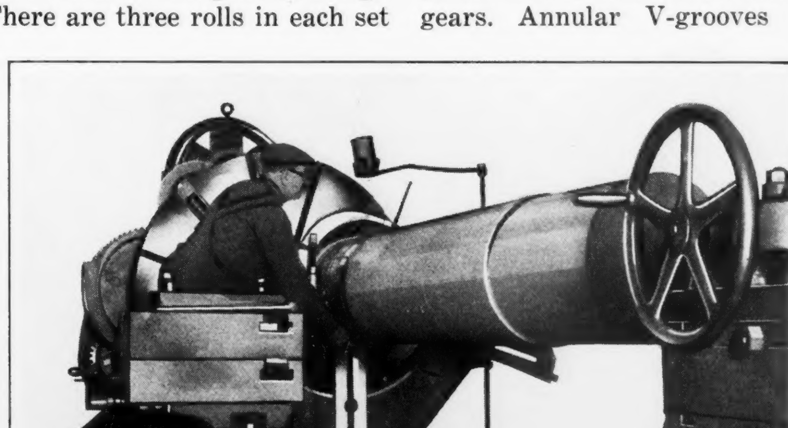


Fig. 1. Turning a Heavy Steel Shaft to Receive a Sugar-mill Crusher or Mill Roll

The operations involved in machining these rolls possess features of unusual interest, as performed in the plant of the Hooven, Owens, Rentschler Co., Hamilton, Ohio, one of the prominent American builders of sugar mill machinery. Some of these operations, as well as interesting methods employed on other parts used in the construction of sugar mill equipment, will be described in this article. Special tooling provides interchangeability of parts, and, wherever possible, parts are machined in multiple.

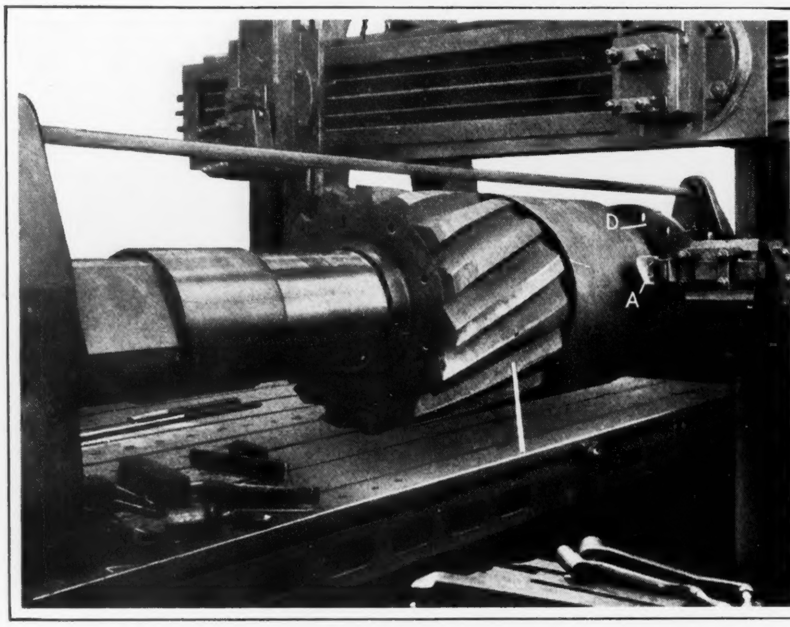


Fig. 2. Planing the McNiel Herringbone Grooves on a Crusher Roll, the Operation being One-half Completed

How the Crusher and Mill Rolls are Assembled on Shafts

The crusher and mill rolls range from 34 to 42 inches in diameter and from 72 to 87 inches in length. They consist of cast-iron or semi-steel shells, which are shrunk on heavy steel shafts prior to the groove-cutting operations but after the shells have been bored and the shafts turned. Fig. 1 shows a typical roll shaft being turned in a lathe of 72-inch swing. These shafts are turned from 0.012 to 0.015 inch over the bored diameter of the shells so as to allow for a tight fit. It is the practice to bore the shells on a horizontal machine.

Before the assembly of a roll on a shaft, the roll is expanded from 0.020 to 0.025 inch by sealing each end with a head and forcing steam into the enclosure for five or six hours. At the end of this time the shaft is forced into the roll under a 500-ton hydraulic press. The shaft in Fig. 1 is approximately 18 inches in diameter and about 190 inches long over all. It is supported in live centers at both ends. Assembled crusher rolls and shafts weigh from 27,500 to 42,000 pounds.

Planing the McNiel Herringbone Grooves

The herringbone grooves previously referred to are known as McNiel grooves. They are planed in the rolls, one end at a time, on an 8-foot planer equipped as illustrated in Figs. 2 and 3. In the first of these illustrations a roll is shown with the grooves completed at one end, ready to have the opposite end machined. Fig. 3 shows the grooves finished on both halves of the roll. Each groove is produced by means of the form cutter *A*, Fig. 2, as the table advances to carry the work past the tool for approximately one-half the roll length. It will be observed that an annular groove is turned around the roll in the middle, before the operation is performed, so as to provide cutter clearance at the end of every stroke. With each of the forward table movements, the roll turns on its axis to give the groove the required helix, the roll shaft being

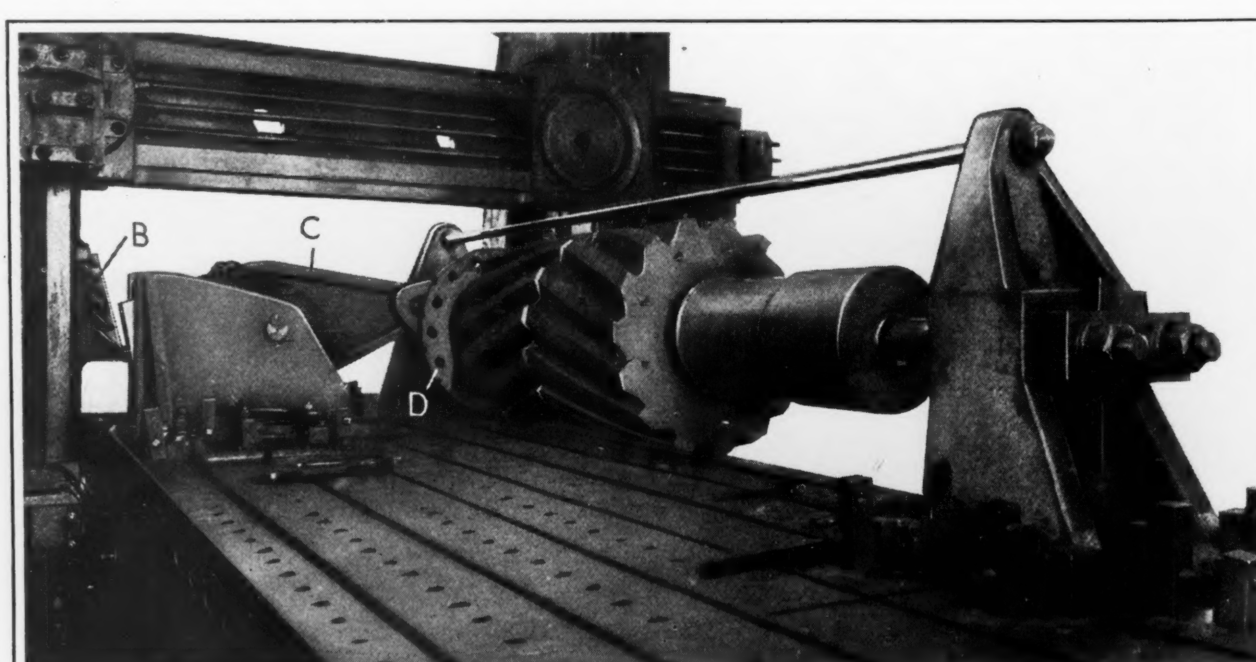


Fig. 3. Another Illustration of the McNiel Groove-cutting Operation Showing the Work-swiveling Mechanism

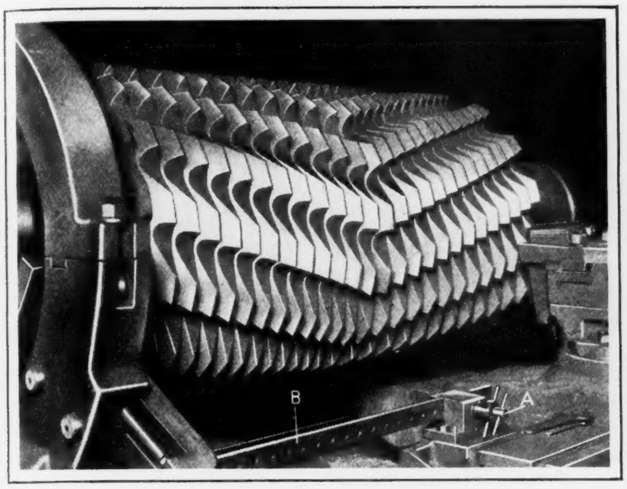


Fig. 4. Turning Annular V-grooves, Three Inches Deep, in a Crusher Roll for its Entire Length

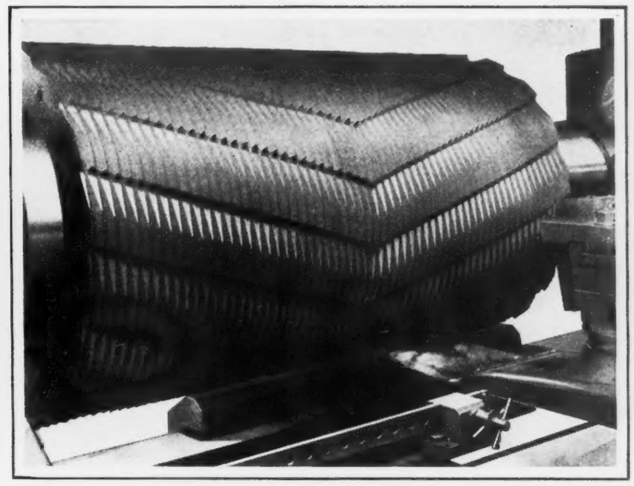


Fig. 5. Mill Roll Having V-grooves of Fine Pitch and McNiel Grooves of Shallow Depth

mounted on centers. During the return stroke, the roll swivels in the reverse direction so as to avoid interference with the tool and position the roll ready for the next cut. Just before each advancing table stroke, the cutter-head is fed forward for the next cut.

Swiveling of the work on its axis during the forward and return strokes of the table is accomplished by the mechanism shown at the left in Fig. 3. Bolted to the left-hand planer housing is a casting which supports a precision guide block *B*. A hardened and ground pin, fastened to the left-hand end of the large rocker arm *C*, engages the under side of this block, causing the rocker arm to swivel and turning the work on its axis when the table reciprocates, according to the inclination of block *B*. This inclination is made to suit the helix of the grooves to be machined on the roll. Tool *A*, Fig. 2, is positioned in the same horizontal plane as the axis of large rolls; for machining small rolls, the tool is held in one of the cross-rail heads and is positioned in line with the vertical axis of the work.

Accurate spacing of the grooves is obtained by means of index-plate *D*, which is fitted to the roll shaft. Each groove is machined to depth before the roll is indexed for starting the next groove.

Turning the Annular V-Grooves

After the McNiel grooves have been machined, the annular V-grooves are turned in a 72-inch lathe arranged as illustrated in Figs. 4 and 5. The included angle of these grooves varies from 45 to 60 degrees in the different crusher and mill rolls, and the depth of the grooves, from 1/2 to 3 inches. In producing V-grooves of coarse pitch, such as in the roll seen in Fig. 4, one groove is cut at a time, with a single tool, but in rolls having grooves of finer pitch, such as shown in Fig. 5, as many as three grooves are cut by using three tools.

Positioning of the tool carriage to suit the desired spacing of the grooves is accomplished by inserting pin *A* into the holes in bar *B*. This bar connects the lathe carriage with the headstock, and as each groove is completed, the pin is merely withdrawn, the carriage moved the required amount to the left, and the pin inserted into the next hole. The annular grooves in the roll shown in Fig. 4 are 3 inches deep, and require approximately sixteen hours for machining.

Shaping the Teeth of Scraper Bars

Bars having teeth that accurately match the annular grooves in the crusher and mill rolls are assembled beneath them in the sugar mills to scrape the pulp from the rolls after the cane has been crushed between them. These scraper-bar teeth are machined, as illustrated in Fig. 6, on a shaper having a long bed, on which the ram carriage can be adjusted the length of the work. A lead-screw in the bed of the machine, provides a power feed for the ram. Hand adjustments of the carriage are obtainable through a handwheel and rack and pinion.

Power for reciprocating the ram is transmitted from a shaft at the back of the machine through a pinion that drives a large gear. A connecting-rod, adjust-

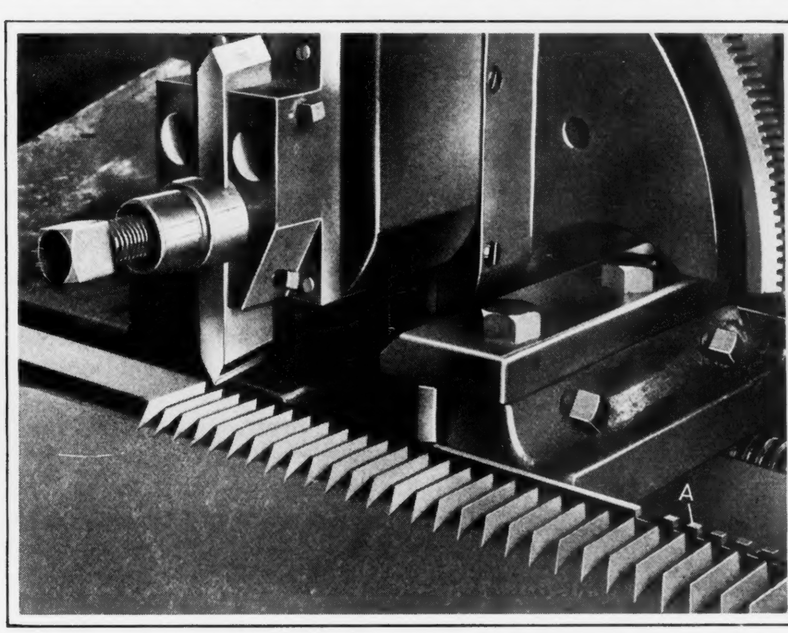


Fig. 6. Shaping Teeth on a Scraper Bar to Match the Annular Grooves of a Crusher Roll

ably attached to one side of the gear, reciprocates the ram. Mechanism is provided for automatically feeding the tool-head downward between strokes until the tooth has been cut to the desired depth.

Accurate spacing of the bar teeth is insured through the use of a notched bar *A*, attached to the front of the carriage and extending toward the right-hand end of the machine. Mounted on the bed at this end of the machine is a lever device equipped with a rack having about five teeth which mesh with the notches in bar *A*. When the tooth-cutting operation is started, the teeth of this rack are entered into the notches in the bar. Then, as each tooth is completed, the lever is merely operated to lift the rack from the bar, and the carriage is moved toward the left to bring the tool into position for cutting the next tooth. With this arrangement, the work is conveniently indexed and held against movement during the operation. Bars *A* and racks with notches of different spacing are available for scraper bars of various pitches.

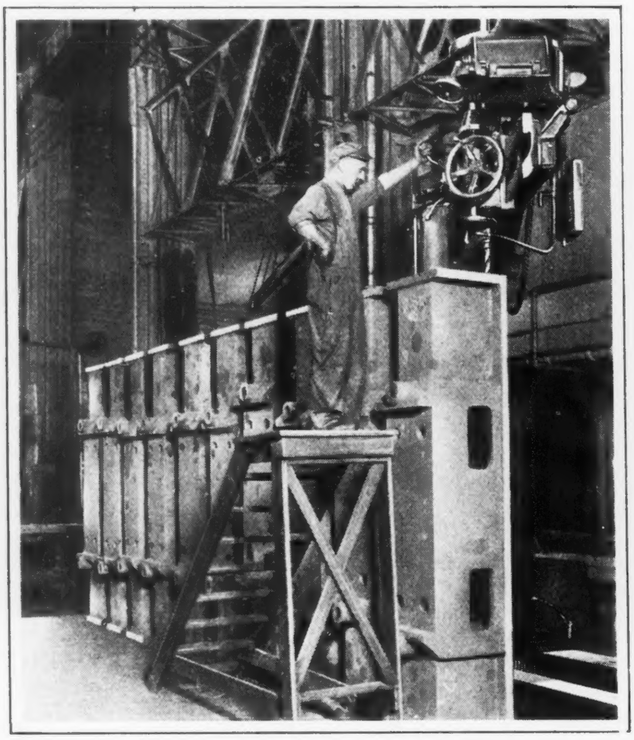


Fig. 7. Traveling Radial Drilling Machine Used for Drilling Holes in High Castings

The scraper bar teeth usually must be machined at a considerable angle relative to the principal surfaces of the casting. Hence the work is held on a table that may readily be tilted to any angle up to 90 degrees. Ram strokes of from 16 to 18 inches are generally employed in these operations. The scraper bars range in length up to about 8 feet.

Traveling Radial Drill Used for Large Castings

Fig. 7 shows a radial drilling machine employed in the drilling of long or high parts. The machine proper is mounted on a bed 22 feet in length, which may be seen in the lower right-hand corner of the illustration. The machine is moved by power along the bed, so that the spindle can be quickly positioned over the work as required. The radial arm is 10 feet long, and the machine handles work up to 10 feet high. In the illustration, bed castings for the gear drives of sugar mill machinery are being drilled at one end.

Planing Operation on Roll Housings

Set-ups such as shown in Fig. 8 are employed for planing the roll housings of sugar mills in multiple. Two rail-heads and two side-heads, one at the front and one at the back, are used simultaneously in the operation illustrated. Twenty-four surfaces are planed at one set-up of the work. On each side of the throat at the top of the castings, there is a surface *A* which corresponds with a surface *B* on both the front and rear of the castings. Both cross-rail heads cannot be employed at the same time in the throat, and so when one of the surfaces *A* is being planed, the second rail-head is used on the corresponding surface *B*. Cuts on the top of the castings are also taken by the rail-heads. Front and rear surfaces *C*, *D*, and *E*, as well as other minor surfaces, are planed with the side-heads.

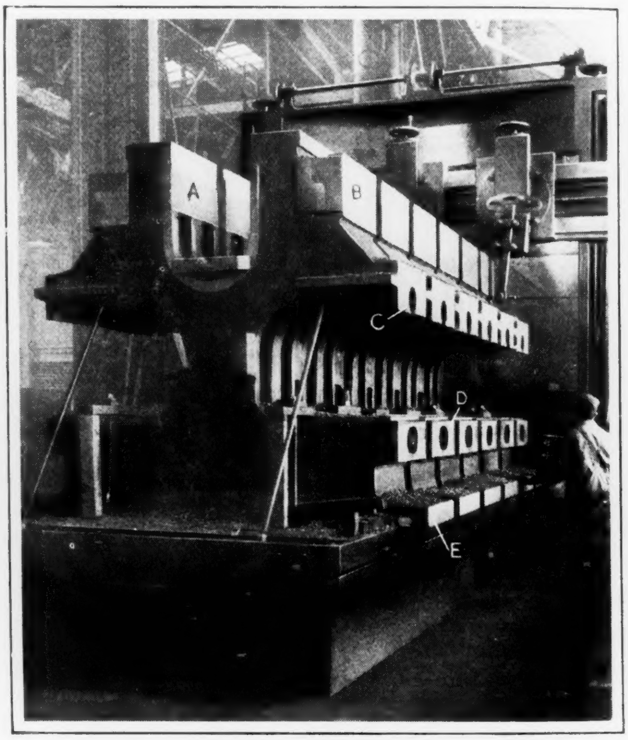


Fig. 8. Planing Twenty-four Surfaces on Sugar-mill Housings at One Set-up

* * *

TRAINING COURSES FOR FOREMEN

The selection of training courses for foremen and supervisors in industrial plants in various fields is discussed in a report entitled "Foremen Training Plans," published by the Policy-holders Service Bureau of the Metropolitan Life Insurance Co., New York City. This pamphlet answers some of the practical questions that are asked from time to time by executives, as for example, "What plan will serve my company best?" and "What features are to be found in the training courses of other companies that may be applicable in our case?" Successfully worked out plans adopted by such companies as the American Rolling Mill Co., the Bethlehem Steel Co., the General Motors Corporation, and many others are included.

Engineers Discuss Industrial Education

The Training of Young Men for the Industries Was An Important Topic at the Rochester Meeting of the Mechanical Engineers

THREE important papers on education and training were read at the Rochester meeting of the American Society of Mechanical Engineers held May 13 to 16. W. E. Wickenden, Director of Investigation for the Society for the Promotion of Engineering Education, read a paper "The Technical Institute—European Examples and Their Significance for American Education;" Virgil M. Palmer, Superintendent of Industrial Economy, Eastman Kodak Co., Rochester, N. Y., presented a paper entitled "Industry Specifies its School Training Needs"; and W. S. Conant, consulting engineer, Washington, D. C., spoke on "The British Apprenticeship Report and its Value to American Industry."

Comparison between American and European Methods of Training for the Industries

Mr. Wickenden, in his paper, emphasized some of the defects in the American system of technical education for the industries. He pointed out that it has developed in a one-sided manner, and that technical education has never been conceived of as a national problem or thought out as a whole. He used the term "technical institute" to designate the type of school of the non-university class which is intended for the education of men on an age level above the secondary schools. There are admirable examples of such institutes in the more carefully planned European systems, for which we have few counterparts.

These European schools, though of great diversity in name, organization, and program, have several distinctive characteristics in common. They are not trade schools, nor are they preparatory schools for higher studies; their courses are of a terminal character and are intended for young men already engaged in industry, who wish intensive preparation for definite lines of advancement; most of their students are not book-minded; direct processes of teaching and learning are employed; and most of the student's work is done on the premises. The entire process aims at the higher practical pursuits of industry rather than at its strictly engineering functions.

The author cited examples from the higher schools of mechanic arts in France, from the local technical institutions of Great Britain, and from the higher schools for machine construction, building construction, and specific industries in Germany, which accept students only after a considerable period of industrial experience. In conclusion, the author recommended a definite plan for schools that would train a much larger proportion of our technical personnel from men who already have had general industrial experience. The major responsibility for filling the present gaps in our training methods appears to rest upon the states and the larger industrial cities, with the national organizations of the engineering profession exercising a role of guidance, in the absence of any national department of education.

A Successful Training School in Rochester

The methods used by the Rochester Mechanics Institute were the subject of Mr. Palmer's paper. This institute is engaged in a cooperative experiment in the training of young men and women for industry. The outstanding feature of the experiment is that the industries of Rochester have been asked to specify how the institute could best meet their educational needs. In finding the answer, the industries first examined the present educational service rendered, and then determined the needs of their employes and outlined their requirements in terms of specifications covering the finished product which they felt that the school should give them. In the light of past experience and with these specifications as a guide, recommendations were made as to the courses that should be given and the methods that should be used in teaching.

The preliminary survey, to determine upon the proper courses, extended over more than a year, and included representative industries in Rochester, construction contractors, and architects. As a result of the investigation, the School of Industrial Arts of the institute now offers three-year cooperative courses for mechanical, electrical, and chemical students, but there are no full-time day courses in these subjects.

British Apprentice Methods

In his paper on the British Apprenticeship Report, Mr. Conant briefly reviewed such points as might be of interest to American manufacturers and of value in developing apprentice methods here. There is an increasing tendency toward classroom instruction in addition to shop work. This instruction is given in continuation classes and evening classes; a few plants maintain classrooms in their works. The cooperative training plan under which an apprentice works one or two weeks in the shop and goes to school one or two weeks is receiving increased recognition, and its advantages are acknowledged. Several British firms would like to adopt this plan, but do not find suitable educational facilities with which to cooperate.

The general conclusion of the British Apprenticeship Report is that apprenticeship is of extreme value in modern industry, and has not outlived its usefulness, but, on the contrary, becomes more important than ever with the present development and organization of the industries. The author states that the proportion of those who receive definite industrial training in the United States is less than in Great Britain, but that our need for the application of apprentice training methods is even greater than that of the British industries.

Cutting Tools, Power Transmission, and Gearing are Dealt with in Machine Shop Sessions

At the Machine Shop Practice sessions, the following papers were read: "Economies which May be Effected in Power Transmission," by W. W. Nichols; "Diamonds as Metal-cutting Tools," by Carl L. Bausch; "Report of an Investigation on Tungsten Carbide Cutting Alloys," by W. Paul Eddy, Jr. and H. J. Long; "Progress Report on Thread Form of Milled Worms," by Earle Buckingham; and "Large Spiral Bevel and Hypoid Gears," by Allan H. Candee.

The paper by Mr. Candee, mechanical engineer of the Gleason Works, Rochester, N. Y., dealt with recent developments in the manufacture of large bevel and hypoid gears, the principal subjects being: (1) Large bevel gears of greatly improved running qualities due (a) to generating instead of planing the teeth, and (b) to the use of spiral teeth instead of straight teeth; (2) a new type of large bevel-gear generating machine, with a description of the mechanical movements used to produce spiral teeth; and (3) the accurate generation of large hypoid gears in which the axis of the pinion is offset from the axis of the gear, thus making it possible for the two shafts to continue past each other.

Belting Should be Given Greater Attention and Care in Most Machine Shops

Commenting upon the economies that may be effected in power transmission, Mr. Nichols, vice-president and mechanical engineer of D. P. Brown & Co., Detroit, Mich., stated that from an economical standpoint of maintenance, power transmission equipment is not given careful consideration by management. It should not be left to the supervision of some old-time millwright. Belting is not given a close enough inspection upon its receipt to determine if it meets all the requirements laid down by the specifications for its purchase.

Heavier belts could be installed profitably in many instances. By this means unnecessary wear and tear upon countershaft clutches would be eliminated. The question of group driving and the economies effected thereby are deserving of being more closely considered and of having their cost compared with individually motor-driven tools, both from the standpoint of initial cost and maintenance.

Diamonds as Metal-cutting Tools

In his paper on the application of diamonds to metal cutting, C. L. Bausch, manager of research and engineering, Bausch & Lomb Optical Co., Rochester, N. Y., recited the history of the use of diamond tools in the plant of his own company, which he believed to be quite representative of the use of diamonds for metal cutting in general. At first, diamonds were used in the turning of materials that were too hard for steel tools. Their next use was in obtaining a high finish on non-ferrous metals; and this, in turn, was followed by their use on work requiring extreme accuracy.

In all cases, high speeds were obtainable, although heavy cuts have never been possible with diamond tools. The paper included data on the proper selection and setting of diamonds; on cutting speeds and feeds; on life of diamond tools; and on the limitations due to vibration. The complete paper is printed in *Mechanical Engineering* (the Journal of the American Society of Mechanical Engineers), May, 1929. Copies of any of the papers referred to may be obtained by addressing the Society at its headquarters—29 W. 39th St., New York City.

* * *

Planning Reduces Tooling Costs

Three fundamental factors should be considered in designing the tooling equipment for a product: First, the necessary degree of accuracy and interchangeability; second, the number of parts required; and third, the amount of money that may be spent for the tools. The first two factors control the third entirely. In July MACHINERY, the article "Intelligent Planning Reduces Tooling Costs" will deal with the methods of supervision of tool designing and tool-room operation to achieve the greatest possible success in this work. Adequate understanding of the principles involved is essential to the economical design, production, and use of tooling equipment.

PRESSED METAL INSTITUTE MEETING

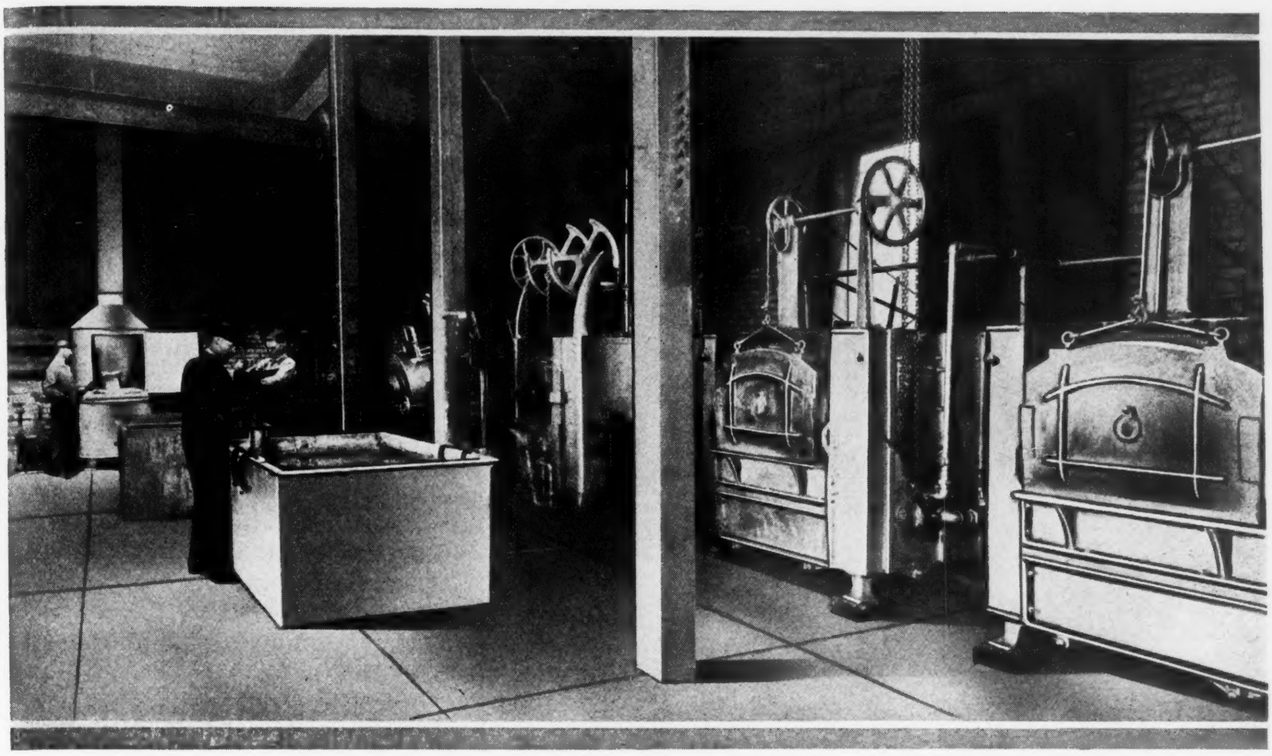
At the annual meeting of the Pressed Metal Institute, held April 26, in Detroit, the following officers were elected: President, Lee O. Benner, sales manager, Pressed Steel Division, Motor Wheel Corporation, Lansing, Mich.; vice-president, Harvey S. Johnson, assistant sales manager, The Bossert Corporation, Utica, N. Y.; members of the executive committee, George D. Shanahan, general manager, Motors Metal Mfg. Co., Detroit, Mich., and William H. Schomburg, vice-president of Bingham Stamping & Tool Co., Toledo, Ohio.

At the meeting, F. Richmond Fletcher of Scovell Wellington & Co., spoke on "Making the Most of Your Cost Finding Methods." An important discussion relating to the predetermining of drawing qualities of steel resulted in a resolution to appoint a committee to secure from every source such information as may be available on this subject. The office of the institute is at 232 Delaware Ave., Buffalo, N. Y., Malcolm Baird is secretary-treasurer.

* * *

HOW TO MAKE AN APPRENTICESHIP SYSTEM SUCCESSFUL

At a foundry conference recently held at the University of Wisconsin, the following conditions for successful apprentice training in a plant were laid down as fundamental: The management must be enthusiastic for apprentice training and convinced that it can be made a success; a careful survey of the facilities for training that the shop can provide must be made before the plan is put into operation, and then the plan must be definitely laid out and responsibility placed for its administration; the cooperation of foremen, department heads, and other advisory officials must be obtained; definite schedules of work and pay must be established; and suitable school courses must be provided with arrangements for proper teaching.



Obtaining Wear Resistance by Nitriding

How Nitralloy Steels are Heat-treated to Improve the Physical Properties, and Nitrided to Obtain a Superior Wearing Surface

By J. B. NEALEY

NITRIDING is a comparatively new process for surface-hardening certain alloy steels, and consists in heating these steels, at comparatively low temperatures, in an atmosphere of nitrogen. Finish-machined surfaces hardened in this way are subject to minimum distortion. They acquire a hardness unobtainable in any other steel, and also considerable resistance to corrosive attack, provided subsequent grinding does not remove too much of the case.

Furthermore, physical properties such as toughness, high impact strength, etc., can be imparted to the core by previous heat-treatments, and such properties as are unaffected by drawing temperatures up to 950 degrees F. are retained after nitriding. So-called "Nitralloy" steels, which are suitable for this process, are readily machineable, and, in the heat-treated as well as the annealed state, show the same degree of smoothness and free cutting properties as other alloy steels of corresponding strength. These steels also forge as easily as ordinary alloy steels of the same carbon content.

The series of alloy steels known as "Nitralloy" and the process of nitriding were developed by Dr. Adolf Fry of the Krupp Co., Germany, and the Ludlum Steel Co. is licensed to make these alloys and use the process in America. Dr. Fry first learned that steel alloys which have absorbed nitrogen, undergo a eutectoidal transformation at approximately 1075 degrees F., and later discovered that the formation of brittle nitride layers could be avoided by holding the nitriding temperature below this transformation point.

Analyses and Tests of Steels Adapted for the Nitriding Process

Inasmuch as ordinary carbon and alloy steels do not acquire any great degree of hardness when subjected to nitrogen, Dr. Fry developed "Nitralloy," in which only a sufficient amount of carbon is included to give the desired physical properties to the core, smaller amounts being employed than is customary in most alloy steels. Two typical Nitralloy analyses are as follows:

Element	Nitralloy "G"	Nitralloy "H"
Carbon	0.36	0.23
Manganese	0.51	0.51
Silicon	0.27	0.20
Aluminum	1.23	1.24
Chromium	1.49	1.58
Sulphur	0.010	0.011
Phosphorus	0.013	0.011
Molybdenum	0.18	0.20

The physical properties of these alloy steels are shown in Tables 1 and 2. Two tests were made in each instance.

Standard specimens (0.505 inch in diameter and 2 inches in gage length) were used for the tensile tests recorded in the tables. The tensile test pieces were quenched in oil after heating for thirty minutes, grade G being quenched at 1650 degrees F., and grade H at 1750 degrees F., and then drawn

at the indicated temperatures for one hour. The Charpy test specimens were treated in the same manner. Values for samples of grades G and H in the annealed conditions are inserted in the tables for purposes of comparison.

At first thought, nitriding may appear analogous to carburizing, but there are marked differences between the two processes. Carburizing is obtained by the well-known method of cementation at temperatures ranging from 1500 to 1850 degrees F., after which the work is heat-treated to refine the grain structure of both the core and case. Nitriding is accomplished in an atmosphere of ammonia gas at approximately 950 degrees F., and then cooled slowly, the work having previously been given the desired heat-treatment.

Table 1. Physical Properties of Grade G Nitralloy Quenched in Oil at 1650 Degrees F.

Drawing Temperatures, Deg. F.	Yield Point, Pounds per Sq. Inch	Maximum Strength, Pounds per Sq. Inch	Elongation, Per Cent in 2 Inches	Reduction of Area, Per Cent	Charpy Test, Foot-pounds	Brinell Test
800	180,000	224,500	11	36	12	445
900	165,000	206,300	11.5	37.5	15	415
1000	158,500	182,500	15	50	22	363
1100	137,500	156,000	16.5	57	35.2	330
1200	120,000	138,000	20	60	44.0	285
1300	103,300	121,000	23	62.5	55.3	226
1400	80,500	104,300	28	59	54.5	200
Annealed	69,000	95,000	30	67.5	31.6	186

Machinery

Comparative Hardness of Carburized and Nitrided Steels

A Brinell hardness of 600 is acquired in carburizing, and is retained at temperatures up to 300 degrees F. only, while Brinell tests of 900 to 1000 are obtained by nitriding, and this hardness is unaffected by temperatures below 1350 degrees F. The case produced by nitriding can be controlled up to 1/32 inch in depth, as the rate of penetration is quite uniform. With a temperature of 940 degrees F., the heating periods generally vary from 24 to 60 hours and sometimes reach 90 hours.

Preparation of Work for Treatment

A selective treatment can be had by tinning or nickel-plating the parts that are to remain unaffected by the nitriding treatment. To avoid any tendency to chip the hard case, care should be taken in designing and preparing parts to be nitrided, to see that all sharp edges are relieved and that suitable fillets are used. Most nitrided work receives only a slight buffing to remove the oxide film, but a high degree of finish can be obtained if desired.

Work that requires a tough core is usually hardened and drawn after rough-machining. Close tolerances must be maintained in finish-machining, as the grinding allowance customary with carburizing practice is omitted in this process. However, allowance for growth due to the absorption of nitrogen, must be made, and this usually amounts to about 0.0005 inch for a case depth of 0.02 inch.

Applying the Proper Treatment

Certain heat-treatments must be applied prior to nitriding, the first being an anneal to relieve rolling, forging, or machining strains. This is usually accomplished by heating the parts to a temperature of about 1000 degrees F. for five hours. The desired physical characteristics are imparted to the core by heat-treating.

The following is a preliminary operation schedule for either G or H Nitralloy parts:

A. *Sections Not Requiring Heat-treatment*

1. Machine, grind, and polish to exact finish dimensions.

Under this heading come parts that are made in one operation on automatic machinery, where it is impossible to apply normalizing treatment between operations. It is obvious that this treatment applies to parts of simple design only.

B. *Simple Sections Machined from Annealed Bar Stock and Requiring Heat-treatment*

1. Cut blanks or rough-machined parts from annealed stock.
2. Heat-treat pieces according to tables for physical properties.
3. Draw at proper temperature for four hours.
4. Finish-machine, grind, and polish.

C. *Forgings, etc., Not Requiring Heat-treatment for Definite Physical Properties, Except Annealing*

1. Forge the same as S.A.E. steels.
2. Anneal forgings at 1450 degrees F. for five hours; cool in furnace. This leaves the metal with a maximum Brinell hardness of 180.
3. Rough-machine.
4. Normalize at 1200 degrees F. for four to five hours.
5. Finish-machine, grind, and polish.

Table 2. Physical Properties of Grade H Nitralloy Quenched in Oil at 1750 Degrees F.

Drawing Temperatures, Deg. F.	Yield Point, Pounds per Sq. Inch	Maximum Strength, Pounds per Sq. Inch	Elongation, Per Cent in 2 Inches	Reduction of Area, Per Cent	Charpy Test, Foot-pounds	Brinell Test
800	156,300	178,800	12	47	20.6	400
900	143,500	170,000	16	49	25.5	365
1000	133,300	160,000	17	54	30.1	340
1100	117,500	134,500	18	61	48.1	290
1200	103,800	122,000	21.5	67	59.2	255
1300	85,500	102,500	27	72	69.0	228
1400	75,000	90,500	32	73	73.0	190
Annealed	60,000	80,000	34	70.5	47.8	157

Machinery

D. *Forgings and Complicated Machined Sections Requiring Heat-treatment for Definite Physical Properties*

1. If forging, forge as S.A.E. steels.
2. If cut from bar or billet, use annealed stock.
3. Heat-treat according to tables for physical properties.
4. Rough-machine.
5. Normalize for four to five hours, at same temperature as used for drawing.
6. Finish-machine, grind, and lap.

It is of the utmost importance in the case of all quenched and drawn parts that are normalized afterward, that drawing and normalizing temperatures be alike. The normalizing temperature may be below, but never above, the drawing temperature.

The technique of the nitriding process is more complicated than that used in the carburizing process, but it has been worked out very carefully and completely at the plant of the Queen City Steel Treating Co., Cincinnati, Ohio. The gas furnace used is of brick, with a hearth 33 by 54 inches, while the boxes in which the parts are treated are 22 by 48 inches. The close control necessary in the various stages of heat-treatment is obtained by gas fuel furnaces.

On one side of the room is a battery of five brick furnaces of the periodic type, of varying shapes and sizes, each fired with two gas burners, one of which is a by-pass burner. The burners fire in a chamber beneath the hearth, and the heat rises on both sides. These furnaces are used interchangeably for various kinds of heat-treatment. A larger furnace for heavier work is 12 feet long by 8 feet wide and 6 feet high, and has six gas burners.

Auxiliary Equipment Employed

Oil and water quenches and regular heat-treatments are adequately provided for. Jib cranes and an overhead monorail system are used to handle the work. A rotary gas fired furnace of the tilting type, with eight gas burners on each side, is used for carburizing and reheating. Furnaces with pots for lead, salt, and cyanide baths are also provided, while several small high-speed tool furnaces are used for small work and experimental purposes. Indicating and recording pyrometers are used to check the work in process. Automatic temperature control apparatus is also used to a great extent. The heading illustration shows some of the gas furnaces used for nitriding.

The boxes used in the nitriding process are of chrome iron or nickel-chromium. They are flanged and the tops are bolted on, asbestos gaskets being used to make them gas-tight. The dry ammonia gas that provides the nitrogen required is caused to flow through the boxes, inlet and outlet tubes being provided for this purpose. Ammonia from the standard commercial tank or container is used, the valve being adjusted to give the desired pressure. Sometimes it is necessary to provide a needle valve to procure greater uniformity in the flow of the ammonia gas.

Control of Gas Flow and Furnace Temperature

The rate of flow must be such that the change of the ammonia gas (NH_3) into nitrogen and hydrogen will always be between 20 and 30 per cent. A temperature of 950 degrees F. is maintained by the aid of a thermo-couple inserted in the box. A much higher temperature would not only hurt the work but also waste the fuel. A temperature much lower than 950 degrees F. would give results entirely unsatisfactory. A thermo-couple in the heating chamber of the furnace is connected with an automatic temperature control thermostat which holds the heat within plus or minus 5 degrees.

The correct flow of ammonia gas through the box is regulated by the aid of a dissociation pipette. The gas must be absolutely dry, and when it passes out of the box, is piped through a water seal which also acts as an ammonia absorbent and gives about 1/2 inch back pressure. The furnace is first brought up to temperature, and the box, charged with the work and sealed, is put into the heating chamber, after which the furnace is also sealed. This causes the temperature of the furnace to drop to about 600 degrees F., and it takes three hours for the original heat to be restored.

When the work has been soaked at the proper temperature for the required period, the box is removed from the furnace and cooled to about 400 degrees F. The flow of ammonia gas, however, is maintained throughout this cooling period. This gives a dull gray finish to the surface. One of the larger parts, so heat-treated at this plant, is a three-foot camshaft for locomotive lubricators. The author recommends gas furnaces for this process because of the close temperature control obtainable with this type of furnace.

* * *

EFFORTS TO ESTABLISH FIRM-BIDDING

Many machine builders recognize the desirability of "firm bids." Firm-bidding has been defined as the submission of a price accurately determined, which remains unchanged unless a change in the buyer's specifications warrants a new and different quotation. Firm-bidding is advocated to do away with shading of prices after a proposal and price have once been submitted, as is so often done in order to meet a competitor's price.

One of the associations in the machinery field has proposed a resolution to submit to its membership, which states that "the practice of manipulating bids as between buyers and sellers reduces a sound business negotiation to the hazards of common gambling; invites the disclosure of confidential information for the purpose of procuring a price advantage; wastes time and energy; and encourages price-cutting at the expense of fair dealing and honest values"—all detrimental to buyer and seller alike.

Firm-bidding, on the other hand, says the proposed resolution, "precludes any prospect of price revision in the mind of the buyer and will logically result in more accurate cost estimates, improved quality of product, increased plant efficiency, maintenance of wages and conditions of work at a satisfactory level, with lower prices to the consumer"—all legitimate considerations in the best interests of both buyer and seller.

It is proposed that the members of the association referred to shall instruct their purchasing agents to encourage the practice of firm-bids in the conducting of their departments, and to use their influence in securing, through their associations and otherwise, the approval of this principle by purchasing agents generally. The practice of open prices is further recommended, and it is proposed to present to the National Association of Purchasing Agents a resolution urging them to approve the principle and to assist in the application of open bidding, in place of the secret bidding now in vogue.

Fixtures for Milling Tractor Engine Parts

Typical Examples of Milling Fixtures for Machining Connecting-rods and Bearing Caps on a Production Basis in a Tractor Plant

THE milling fixtures described and illustrated in this article were developed to meet the production requirements of tractor manufacturing plants. The design shown in Fig. 1 is employed for the rapid and accurate milling of connecting-rod bosses to length. The heavy black lines in the view at *A*, Fig. 2, indicate the surfaces milled. About 1/8 inch of stock is removed, and in the case of the large boss, the work must be held within a tolerance of 0.005 inch.

This operation is performed on a Cincinnati 48-inch duplex automatic miller, equipped with two special headstocks, each carrying two horizontal spindles. The front spindles are mounted on slides which can be moved toward or away from the rear spindles. The center-to-center distance between the spindles can thus be properly adjusted for milling the bosses on rods of different lengths. Quill adjustment is provided for all four spindles, so that the distance between the ends of the milling cutters can be accurately adjusted.

The work is held in a universal fixture made of three separate units, as shown in Fig. 1. Removable locating blocks adapt the fixture for holding connecting-rods of five different lengths. This complete fixture is mounted on top of a special Cincinnati 16 by 48 index base, which has a long top plate with T-slots to allow various settings of the fixtures for connecting-rods of different lengths.

Crosswise location of the connecting-rods is maintained by having the bolt lug on the large end rest in a solid V-block *B*, and the I-section near the boss at the small end rest in a spring V-block *D*, which is depressed when the work is clamped in position. The small end of the rod rests on an equalizing support, while the large end is clamped in position by turning the pilot wheel *E*, which forces a V-shaped clamp *F* down over the uppermost bolt lug boss. The small end of the rod is clamped in place by turning the pilot wheel *G*. The V-block *D* under the I-section is depressed when the small end of the work is clamped in place, and serves only as a means for properly aligning the rod in the fixture.

The use of the special index base allows the operator to remove and load the work in the forward fixture during the milling operation. Hence, the only idle machine time is the rapid traversing and indexing time. An extension control handle permits starting and stopping the table travel from the loading position. The indexing and clamping lever of the index base is shown at *A*.

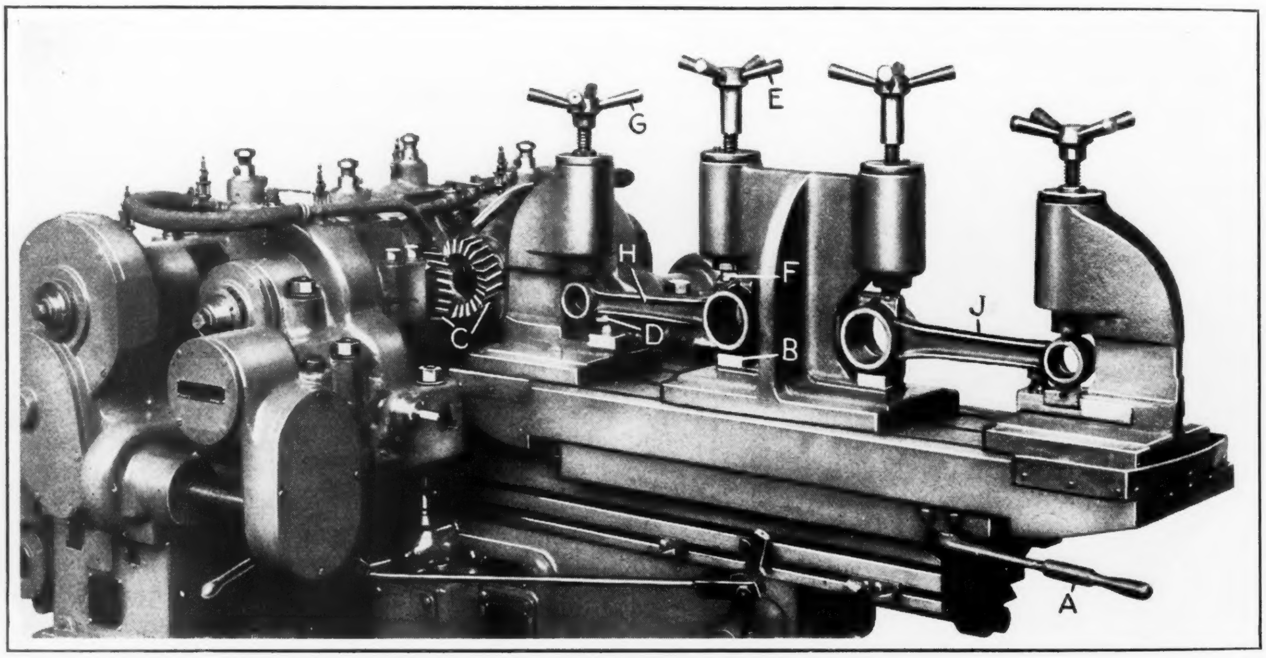


Fig. 1. Indexing Type of Fixture Employed for Rapidly Milling Connecting-rod Bosses

Milling Connecting-rod Bosses at the Rate of Forty Per Hour

Since the piston-pin boss is shorter across the faces than the crankpin boss, the rod is milled by having the piston-pin end pointed toward the cutters, which are set to mill the proper widths. The cutters employed on the machine shown in Fig. 1 are of the shell end-mill type. Those that finish the ends of the small boss are 3 1/2 inches in diameter and run at a speed of 70 revolutions per minute, while the cutters *C* that mill the ends of the large boss are 7 inches in diameter and run at a speed of 33 revolutions per minute. The time per piece on this work is 1.28 minutes, and the regular production, 40.7 pieces per hour.

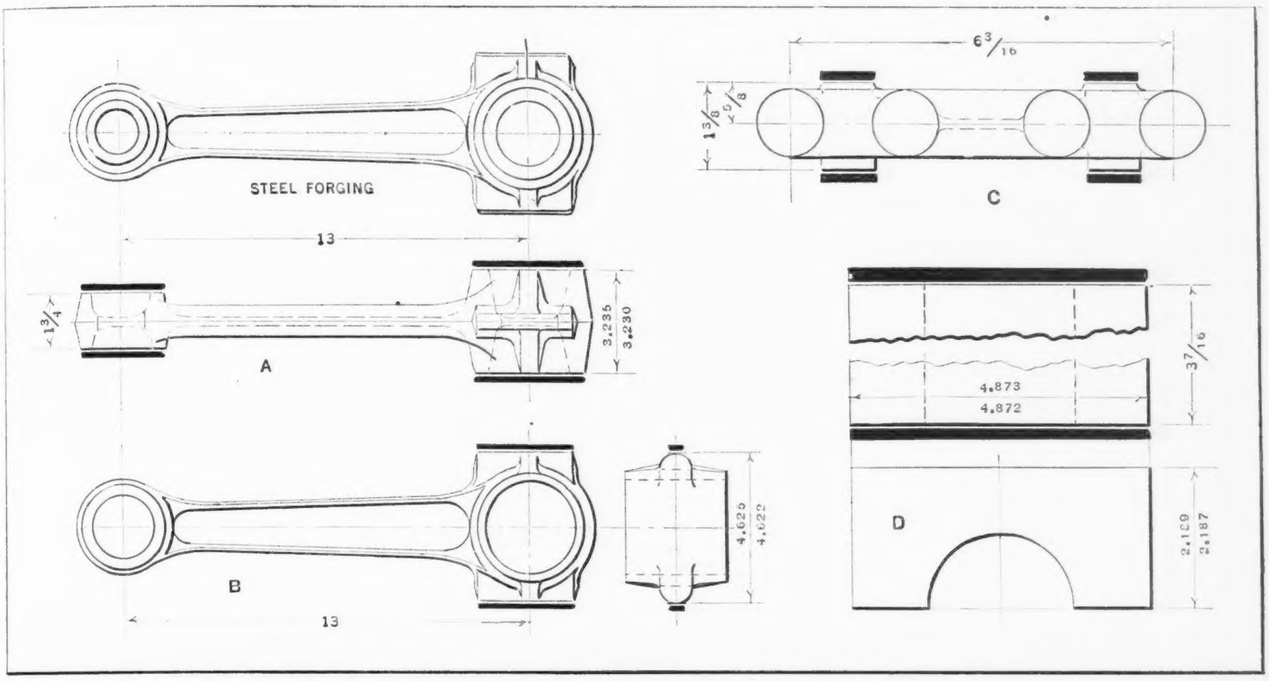


Fig. 2. Tractor Engine Parts Machined in Fixtures Shown in the Accompanying Illustrations

Milling Locating Pads on Connecting-rods

An exceptionally efficient fixture for milling the locating pads at the crank end of forged steel connecting-rods is shown mounted on the table of a Cincinnati 24-inch plain automatic heavy-duty miller in Figs. 3 and 4. About 1/16 inch of stock is removed from the pads at the points indicated by the heavy black lines in view *B*, Fig. 2. The distance between the finished surfaces of the pads must be held between limits of 4.625 and 4.622 inches.

For this operation, half side-mills, 7 1/2 inches in diameter, are employed. The cutter speed is 33 revolutions per minute; the feed, 3.52 inches per minute; and the time per piece, 0.5 minute. The regular production time is 104 pieces per hour. As shown in Fig. 3, two connecting-rods are machined simultaneously, being held on a special universal fixture at an angle of 80 degrees with the table. The finish-bored holes at the ends of the connecting-rods fit over locating studs. Tongues on the rear faces of the locating stud collars position these members on the fixture. Five slots like the one shown at *C* provide for the proper positioning of the locating studs for rods of different sizes.

The block *A*, actuated by the pilot wheel *B*, clamps the finished ends of the connecting-rod bosses against the flat collars *D* on the locating studs. The operation consists simply of a rapid traverse movement to the cutting position, a feeding movement at the proper rate, and a rapid return movement to the loading position.

Milling Valve Lifter Guide Brackets in Fixtures Adjustable for Different Sizes

The milling of both sides of valve lifter guide brackets on the surfaces indicated by heavy lines in view *C*, Fig. 2, is performed at the rate of 128 pieces per hour on a 24-inch duplex automatic miller equipped with the fixtures shown in Fig. 5. About 1/8 inch of stock is removed from each of the four surfaces machined on these malleable-iron parts. Shell end-mills, 2 1/2 inches in diameter, are used in this case, one being mounted on a standard arbor, and the other on an extension arbor. The cutter speed is 104 revolutions per minute, and the feed, 12.8 inches per minute.

The work is held in universal fixtures mounted on a standard 12 by 24 index base *F*, which, in turn, is bolted securely to the machine table. One piece

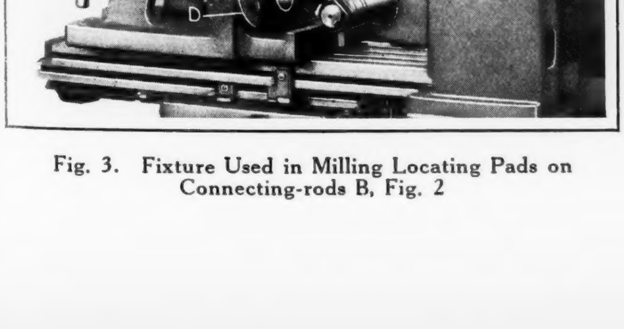


Fig. 3. Fixture Used in Milling Locating Pads on Connecting-rods B, Fig. 2

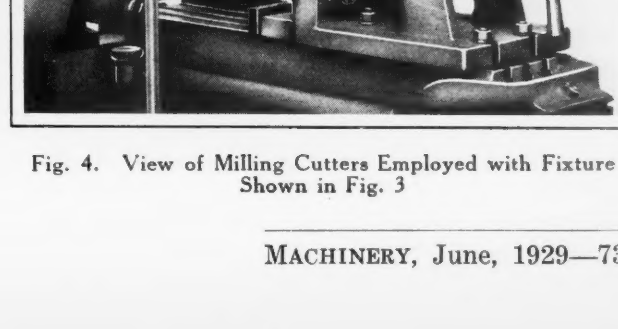


Fig. 4. View of Milling Cutters Employed with Fixture Shown in Fig. 3

of work W is held in each of the two fixtures at opposite ends of the indexing table. The term "universal" is applied to these fixtures because they can be adjusted to suit guide brackets of different sizes by merely changing the locating members.

The sidewise location of the work is obtained by a fixed V-block D and a spring-actuated V-fork E, the fixed fork acting as an end-stop. The strap A with an equalizing clamping foot at B serves to hold the piece securely in the fixture.

Multiple Fixture for Milling Ends of Bearing Caps

A fixture designed to increase production in the milling of bearing caps is shown in Fig. 6. This fixture is designed to hold three cast-iron bearing caps while their ends are milled, as indicated by the heavy black lines in view D, Fig. 2.

Two shell end-mills, 3 inches in diameter, running at a speed of 81 revolutions per minute, perform the required operation. About 1/8 inch of stock is removed at a feed of 12.8 inches per minute. The production on this job is 114 pieces per hour. By simply changing the locating blocks, bearing caps of different sizes can be readily accommodated.

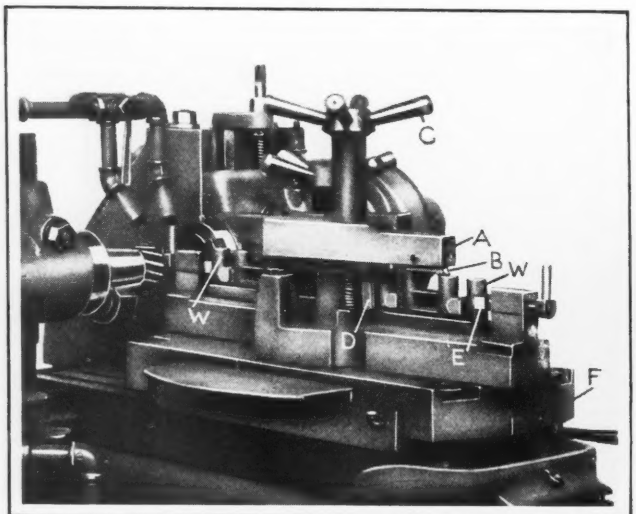


Fig. 5. Milling Sides of Valve Lifter Guide Brackets

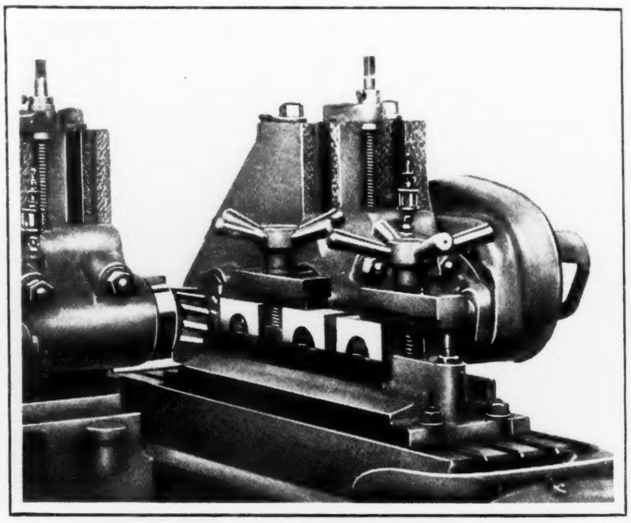


Fig. 6. Milling the Ends of Cast-iron Bearing Caps

The parting faces, which are finished in a previous operation, rest firmly on a locating plate. The work is located and prevented from moving endwise by two fixed end-stops. The first piece is clamped in place by a single pilot-wheel-operated clamp, and the second and third pieces are clamped in position by another clamp tightened in place by a second pilot wheel. The first piece is clamped while the table is idle, and the second and third pieces are loaded in place while the first piece is being machined.

* * *

A cooperative course in railroad transportation is conducted by the Massachusetts Institute of Technology. This course, designed to provide scientific instruction as well as practical experience, is of five years duration and leads to a master's degree. The first two years are spent entirely at the institute. The students then alternate between the school and the Boston and Maine railroad shops or offices.

COMMERCIAL ARBITRATION IN THE MACHINERY FIELD

Machinery groups in ever increasing numbers are following the lead of such associations as the American Boiler Manufacturers Association, the American Institute of Refrigeration, and the Pressed Metal Institute, in expressing interest in the application of commercial arbitration to the machinery industry. According to Lucius R. Eastman, president of the American Arbitration Association, the acknowledged leaders of the industry, individually, have upon many occasions endorsed the principles of arbitration, and its practical use is now being effected in a comprehensive degree.

Several societies and associations, at their meetings, have been addressed by authorities on arbitration furnished by the American Arbitration Association. Others, including the Pressed Metal Institute and the American Institute of Refrigeration, have requested speakers for conventions in the near future. A number of machinery groups have placed formal resolutions of endorsement of arbitration before their boards of directors, while several have indicated interest in affiliating with the American Arbitration Association, 342 Madison Ave., New York City, so that actual machinery for settlement of business disputes might be set up. In making this announcement, Mr. Eastman placed at the disposal of all recognized machinery groups the facilities of the American Arbitration Association in organizing arbitration systems within their respective fields.

Nearly 6000 arbitrators have been appointed throughout the country to serve without pay in settling business disputes as a contribution to the cause of commercial peace. These men are of outstanding integrity in their respective communities, and their services, in 1600 commercial centers, are available to the machinery groups affiliated with the American Arbitration Association.

* * *

The tractive force of the locomotives installed on American railroads in 1928 averaged over 50,500 pounds, while the locomotives scrapped in that year had an average tractive force of only 30,800 pounds.

Die-Casting Alloys and How to Select Them

Information Compiled with a View to Helping the User of Die-castings Select the Alloys from Which Different Castings Should be Made

DIE-CASTINGS produced under pressure are ordinarily made from one of four groups of alloys. These groups have as their base metal aluminum, zinc, tin, and lead, respectively. Each alloy has characteristics different from the others, which make it particularly suitable for certain kinds of service. For instance, some of the alloys possess excellent corrosion-resisting qualities, while others are only fair in this respect; some have good machining properties, while others cannot be machined with any degree of satisfaction; and some can be soldered with ease, while attempts to solder others usually result in failure. Strength is another property that varies widely with the different alloys.

Users of die-castings often experience difficulty in deciding what alloys should be specified for different castings to best meet the requirements of the service for which they are intended. This comes from lack of knowledge concerning the advantages and disadvantages of the different alloys. The Alemite Die-Casting & Mfg. Co., 2642 Belmont Ave., Chicago, Ill., has recently performed a distinct service to the trade by preparing the accompanying table, which tells at a glance the peculiar characteristics of eight common alloys from which this concern produces die-castings. The various standard chemical symbols are used in this table, as follows: Aluminum, Al; copper, Cu; nickel, Ni; zinc, Zn; tin, Sn; lead, Pb; antimony, Sb; and silicon, Si.

General Characteristics of Aluminum-base Alloys

The aluminum-base alloy most commonly used, both for aluminum die- and sand-castings, is known commercially as No. 12 and is the alloy designated as AL-1 in the table. This alloy contains 92 per cent aluminum and 8 per cent copper, and has a tensile strength ranging between 18,000 and 20,000 pounds per square inch.

Alloy AL-4 contains a somewhat smaller percentage of copper and aluminum, but has small amounts of nickel and silicon added. This alloy gives a closer grain than the first mentioned, and is more ductile, tougher, and stronger. It has a tensile strength ranging from 28,000 to 30,000 pounds per square inch.

The AL-5 alloy is comprised only of aluminum and silicon, both of these elements being present in larger percentages than in either of the other two aluminum-base alloys. This is the lightest in weight of the three, and has the same tensile strength as the AL-4 alloy.

All three of these aluminum-base alloys melt at the comparatively high temperature of about 1150 degrees F., which interferes with their being cast as accurately as tin-, lead-, or zinc-base alloys. The AL-1 alloy is the one most commonly used, owing to the fact that it offers greater economies than the other aluminum-base alloys.

It will be seen from the table that the aluminum-base alloys are lightest in weight, possess good plating and machining qualities, have very good corrosion-resisting properties, and lend themselves well to the application of enamels and other liquid finishes. However, they have very poor soldering properties.

Advantages and Disadvantages of Zinc-base Alloys

Three zinc-base alloys are also commonly used by the Alemite Die-Casting & Mfg. Co. Two of these, Z-1 and Z-2, contain 89 1/2 and 86 per cent zinc, respectively, small amounts of tin and copper, and approximately 1/2 per cent of aluminum. These alloys have a tensile strength ranging from 18,000 to 20,000 pounds per square inch, and compare favorably in physical characteristics with cast iron. They melt at 770 and 780 degrees F., respectively, and weigh 0.24 pound per cubic inch, which is considerably more than the aluminum-base alloys.

Alloy Z-8 contains 93 per cent zinc, 3 per cent copper, and 4 per cent aluminum. It is the strongest of all die-casting alloys employed by this company, having a tensile strength ranging from 35,000 to 40,000 pounds per square inch. This alloy may be compared with malleable iron in physical properties. It melts at 750 degrees F. and weighs 0.22 pound per cubic inch.

The plating qualities of zinc-base alloys range from good to very good, the soldering qualities from poor to good, and the corrosion-resisting qualities from fair to good. Enamel and other liquid finishes can be applied to all three of the zinc-base alloys with a high degree of satisfaction, and their machining qualities are excellent.

When are Tin- and Lead-base Alloys Desirable?

Alloys with a base of tin or lead are used in a wide range of mixtures from the low-priced antimonial-lead alloys to the so-called "high-speed" tin-base babbitt mixtures. Generally speaking, tin- and lead-base alloys melt at approximately 400 degrees F., but mixtures are obtainable having melting points considerably above or below this temperature.

Both the tin- and lead-base alloys resist corrosion to a marked degree, and because of their low melting points may be cast with greater accuracy than either aluminum- or zinc-base alloys. Castings of considerable weight can be obtained with ease. These castings have also good plating and soldering properties, but their machining qualities range from fair to very poor. Enamel and other liquid finishes can be applied satisfactorily.

Choosing Alloys on the Basis of the Information Given in the Table

All conditions that die-castings are to meet in service should be carefully analyzed before selecting the alloys from which the castings are to be

made. This can be readily done by the aid of the table. The question should be asked, "Is the casting to be subjected to severe shocks, strains or wear?" If so, an alloy having an adequate tensile strength should be chosen. If any part of a casting is to be used as a bearing surface, the speeds and loads met with in service should be carefully considered. Under such circumstances, one of the alloys may suffice, but it may be necessary to cast brass, bronze, or steel inserts in the parts.

"Is the casting to be plated?" is another important question. If it is, one of the zinc-base alloys is most desirable. "Is it necessary that the casting be soldered?" If so, alloys Z-1, Z-2, T-1, or L-1 should be employed. When lightness is a primary requirement, the casting should be made from one of the aluminum-base alloys.

In the event that the die-castings are to come into contact with water, gases, or other corrosives, including food products, one of the aluminum-base alloys should be employed. When strength is not an important factor in such service, a tin-base alloy could be used; or where it is possible to tin the castings, one of the zinc-base alloys would be suitable.

For use outdoors, where the castings come into contact with hands or moisture in the air, they should be either polished aluminum or else plated zinc-base castings. If the castings are required to be extremely accurate, it is well to make them from an alloy giving the least and most consistent amount of shrinkage, such as alloys Z-1 and Z-2, which have a shrinkage of 0.006 inch per lineal inch.

Tolerances for Alloys

Die-casting accuracy depends upon several factors. Variations may be due to the alloys used, to the general shape of the castings, to the conditions under which they are made, etc. Under ordinary conditions, the variations in shrinkage which occur are in direct relation to the temperature at which the castings are made; the lower the melting point of the alloy, the less the shrinkage. Shrinkage can be reduced by permitting the castings to cool in the dies, but most economical production necessitates cooling in air, which results in free shrinkage.

As a general rule, a variation of 0.005 inch, plus or minus, should be allowed for, per lineal inch, on all dimensions parallel with the parting lines of lead- and tin-base castings. On castings made from alloy Z-8, a variation of plus or minus 0.0015 inch should be allowed per lineal inch on such dimensions; while on the zinc-base alloys Z-1 and Z-2, the allowance should be plus or minus 0.001 inch per lineal inch. With the aluminum-base alloys, the allowance should be plus or minus 0.0025 inch per lineal inch.

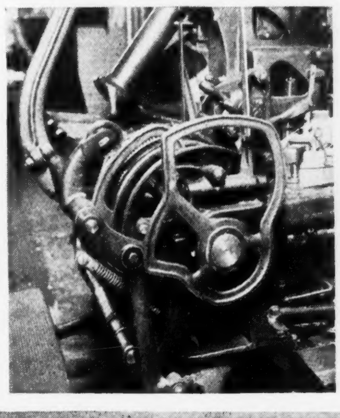
All the foregoing allowances are to be made only on dimensions parallel with the parting lines of die-castings. Dimensions at right angles to parting lines are subject to somewhat greater variation, and in such cases, it is customary to specify limits of plus 0.005 inch and minus 0.000 inch, regardless of the magnitude of the dimensions.

Physical Properties of Die-casting Alloys

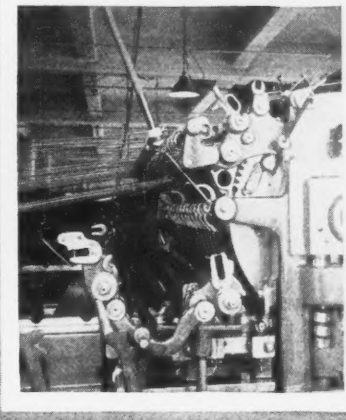
Symbol	AL-1	AL-4	AL-5	Z-1	Z-2	Z-8	T-1	L-1
Formula, with Constituents in Per Cent	Al. 92 Cu. 8	Al. 90 Cu. 5 Ni. 3 Si. 2	Al. 95 Si. 5	Zn. 89½ Sn. 6½ Cu. 3½ Al. ½	Zn. 86 Sn. 8 Cu. 5½ Al. ½	Zn. 93 Cu. 3 Al. 4	Zn. 84 Cu. 7 Sb. 9	Pb. 90 Sb. 10
Tensile Strength, Pounds per Square Inch	18,000 to 20,000	28,000 to 30,000	28,000 to 30,000	20,000	18,000 to 20,000	35,000 to 40,000	Varies with Mixture	Varies with Mixture
Melting Point, Degrees F.	1150	1150	1150	770	780	750	Varies with Mixture	Varies with Mixture
Fusing Point, Degrees F.	1025	1025	1025	450	300	710	Varies with Mixture	Varies with Mixture
Weight per Cubic Inch, in Pounds	0.105	0.115	0.095	0.24	0.24	0.22	Varies with Mixture	Varies with Mixture
Shrinkage per Lineal Inch, in Inches	0.008	0.008	0.008	0.006	0.006	0.008	0.002	0.002
Plating Qualities	Good	Good	Good	Good	Very Good	Very Good	Very Good	Good
Soldering Qualities	Very Poor	Very Poor	Very Poor	Fair	Good	Poor	Very Good	Good
Corrosion Resisting Qualities	Good	Very Good	Very Good	Fair	Fair	Good	Very Good	Very Good
Suitability for Enameling and Other Liquid Finishes	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Good	Good
Machining Qualities	Good	Good	Good	Very Good	Very Good	Very Good	Fair	Very Poor
Elongation in 2 Inches	1 Per Cent	....	2½ Per Cent	....	2 Per Cent	2 Per Cent	Varies with Mixture	Varies with Mixture
Brinell Hardness Number	60	....	50	....	53	57	Varies with Mixture	Varies with Mixture

* * *

California has more automobiles in proportion to population than any other state in the Union. There is slightly more than one car to every three persons in that state.



Ingenious Mechanical Movements



DRILL POINTING MACHINE MECHANISM

By EDWARD OLIVER, Oliver Instrument Co., Adrian, Mich.

The mechanism to be described in this article is part of an automatic drill grinding machine. It is particularly interesting from the designer's point of view, because it produces a really complicated movement with a very small number of moving parts. The practical application of the mechanism will be clear by referring to Fig. 1. At *B* is shown diagrammatically a drill point as ordinarily ground, with a practically constant angle of point clearance.

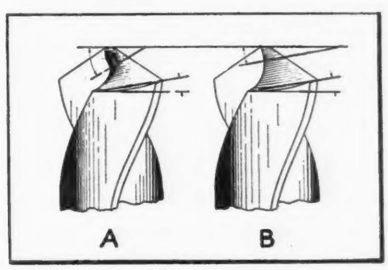


Fig. 1. Two Types of Drill Points

At *A*, Fig. 1, is shown an exaggerated view of a theoretically correct drill point, in which the angle of point clearance increases very rapidly as the web of the drill is approached. In order to grind drills to the theoretically correct point shown at *A*, the drill is mounted in a holder as shown diagrammatically in Fig. 3, which is rotated and advanced in timed relation to a forward and backward movement of the grinding wheel.

The forward and backward travel of the grinding wheel through a distance *L*, Fig. 2, is obtained by a face cam *E* bolted to the hollow quill *C* in which the grinding wheel spindle *D* is mounted. A spring *G*, acting on a plunger, keeps the cam in contact with *F*. The grinding wheel spindle is driven by a belt running on pulley *P*.

The quill *C* is rotated in synchronism with the drill-holder by gear *I* which meshes with gear *H* on the quill. Gear *I* is, of course, part of a gear train which drives the drill chuck. The movement of the wheel is so timed that both lips of the continuously rotating drill are ground in one operation.

Assuming, for instance, that one of the lips of the rotating drill is in contact with the face of the grinding wheel along a horizontal plane passing through the axis of the wheel, the continued rotation of the drill in the direction indicated by the arrow in Fig. 3 will be accompanied by a forward movement of the grinding wheel. These combined motions result in grinding a clearance, the angle of which increases toward the center.

Now, in addition to the movements described, the grinding wheel also has a transverse oscillating movement through a distance indicated by *M*, Fig. 2, which is timed or synchronized with the other two movements. The dotted arcs in this illustration indicate the extreme positions of the periphery of the grinding wheel. The transverse motion

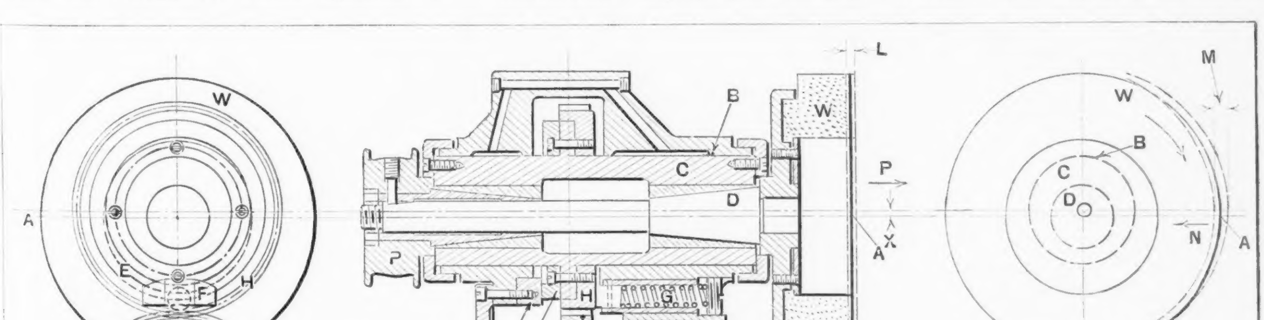


Fig. 2. Mechanism Used in Drill Point Grinding Machine

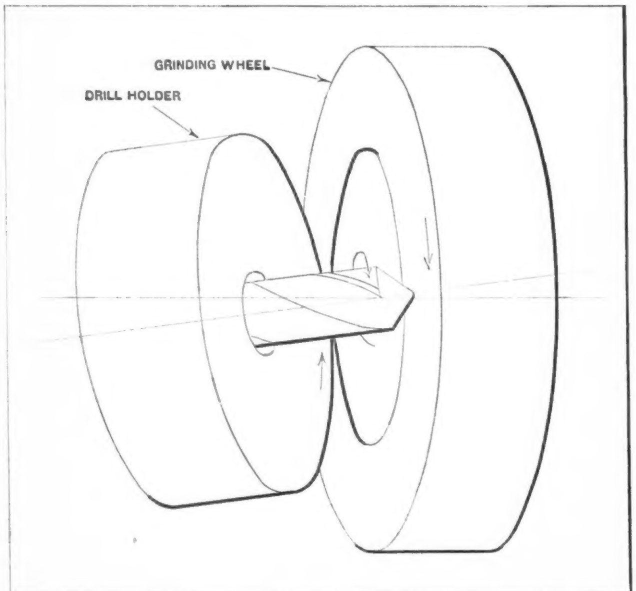


Fig. 3. Diagram Showing Relative Positions of Drill-holder and Grinding Wheel

is necessary in order that the grinding point *A* on the periphery or edge of the wheel shall be in line with the center of the drill when the chisel point is vertical. When the drill reaches this position, the grinding wheel is on the receding portion of its transverse movement or, in other words, is moving to the left in the direction of arrow *N*, and at the same time forward in the direction of arrow *P*.

The forward movement, in conjunction with the rotation of the drill, produces the increased clearance previously described, while the transverse movement carries the grinding edge of the wheel at *A* to the left at the proper time and rate of travel to prevent cutting off the end of the chisel point, and instead produces a greater clearance in front of the cutting part of the chisel point. This has the effect of decreasing the angle of the chisel point and the diameter of the dead center, and increasing the active length of the cutting lip.

The transverse movement *M*, Fig. 2, is obtained by locating the spindle *D* off center in the quill *C* an amount equal to dimension *X*, which gives a movement *M* equal to 2*X*. The eccentric or planetary motion does not interfere with or have any effect on the grinding action resulting from the transverse movement of the grinding point *A*.

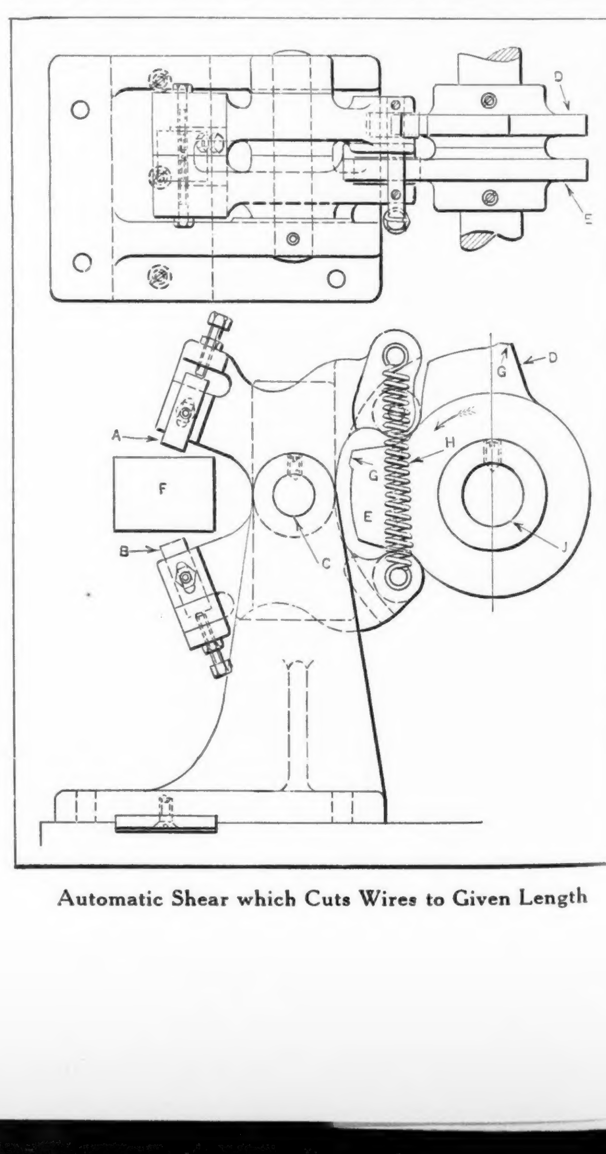
In this mechanism, there are but two movable units, and the points of contact that regulate or control the motions are all combined within a minimum space, so that there can be practically no lost motion to affect the accuracy of the motion imparted to the grinding point *A*. In fact, this mechanism has replaced the original design in which there were about fifteen major parts and in which the distance between the contact points of the parts corresponding to *E* and *F* and the wheel at *A* was about ten times as great as in the new mechanism. The contact point of the parts previously employed to give the travel *M* was thirty times as far from the grinding point *A* as in the eccentric arrangement described. The table on which the drill-holder is mounted has a hand-operated slide which can be advanced in a direction parallel with the axis of the quill *C*.

CAM-OPERATED SHEAR

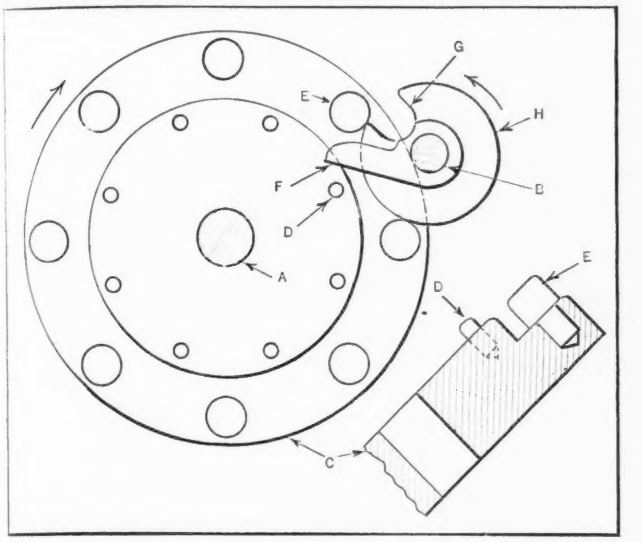
By EDWARD T. HEARD

The cam-operated shear shown by the side and plan views in the accompanying illustration is used for cutting wires to length after they have been swaged. The arms that hold the shear blades *A* and *B* are mounted on shaft *C*, and are operated by cams *D* and *E*. The wire to be cut passes through and is held by a collet chuck mounted in a cam-operated slide *F* (shown in outline only). The movements during one cycle are as follows:

After a wire has been cut to length, the shears open wide, and slide *F* and the wire which is gripped by the collet chuck are advanced, the wire being fed from a roll. During this advance movement the slide passes between the shear blades in order to feed the wire into a swaging head which reduces the diameter throughout most of its length. The slide and wire then return to the cutting-off position, and shears *A* and *B* close on the wire, due to the action of cams *D* and *E*, but the shear blades only nick the wire slightly so as to hold it while the chuck, after being released, is withdrawn to the starting point; then the wire is again gripped by the chuck and the shearing operation is completed as the small rises *G* on cams *D* and *E* pass beneath the rollers of the shear blade levers. As the rollers pass down the steep part of each cam, the shear blades again open wide, another length of wire is advanced, and the cycle just described is repeated. Spring *H*, connecting the roller ends of the shear blade arms, keeps the rollers in contact with the cams. Slide *F* is advanced and withdrawn by a cylindrical cam on shaft *J* (not shown in the illustration). Motion is also derived from shaft *J* for operating the chuck opening and closing mechanism.



Automatic Shear which Cuts Wires to Given Length



Intermittent Motion for Dial Feed Mechanism of Buffing Machine

INTERMITTENT MOTION FOR DIAL FEED

By J. E. FENNO

An intermittent motion which is incorporated in an automatic station-dial machine for buffing brass shells is so designed that shaft *A* (see illustration) revolves intermittently and has eight dwelling periods per revolution, each dwell being equivalent to 3/5 revolution of driving shaft *B*. The disk *C* is fastened to shaft *A*, and in it there are eight equally spaced hardened steel pins *D* and an equal number of larger pins *E*. As the sectional view shows, pins *D* are located on a higher level than pins *E*.

As shaft *B* revolves in the direction indicated by the arrow, a finger *F* first engages pin *D* and turns disk *C* until the larger pin *E* is engaged by notch *G*; when *F* leaves pin *D*, the positive drive between *E* and *G* continues until one-eighth revolution of disk *C* is completed. Then the concentric surface *H* is in contact with and tangent to two of the pins *E*, thus locking the driven disk in the dwelling position until the driver is again in position for an indexing movement.

DOUBLE-ACTING WIDE-OPENING CLAMP FOR FIXTURES

By F. MAYOH

The unusual lever-operated clamping device here illustrated is used in fixture construction, and is so arranged that a piece of work *A* will be clamped down against a surface *B* and pushed along in the direction of the arrow *C* against a stop at the opposite end. This is accomplished with a single clamp *D*, which is mounted in a block *E* on a pivot pin *F*. The clamp is shown by the full lines in position for holding the work in place; when the work is removed, the clamp assumes the position shown by the dotted lines *G*. Clamping or unclamping requires only one movement of hand-lever *H*. This lever is shown in the clamped position by the full lines, and in the unclamped position by the dotted lines at *I*.

The clamp has a forked end and a roll *J*. In the bed of the fixture is mounted a formed plate *K* with beveled surfaces as indicated. This plate is held in position by two dowel-pins *L*. Pivoted to the sliding block *E* is a link *M*, which is connected to lever *H* by a pin *N*. The lever is pivoted on a pin at *P*.

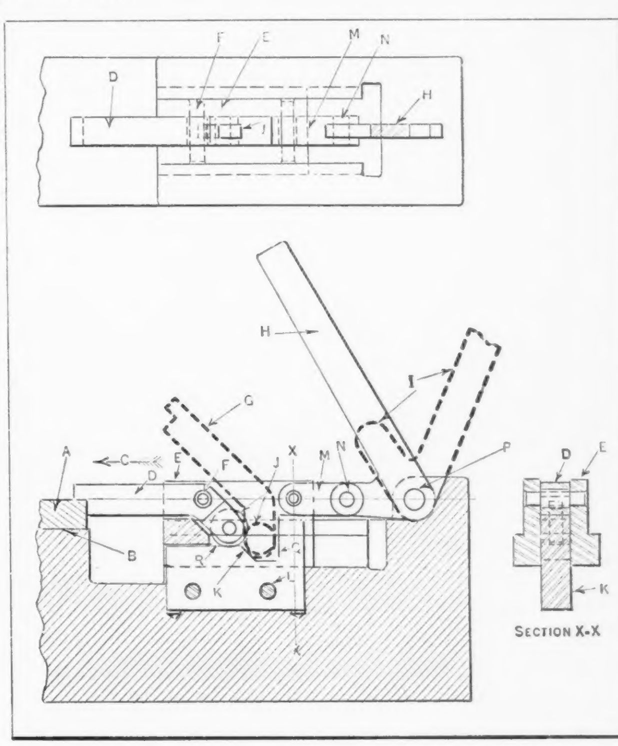
This clamping mechanism functions as follows: With the lever in the position shown at *H*, the operator pulls it to the position shown at *I*; this swings link *M* up and, through slide *E*, draws clamp *D* back clear of the end of work *A*. As this is taking place the roll *J* comes in contact with surface *Q* on the stationary block *K*, which causes the roll to swing down into the cut out space provided, thus raising the clamp to the position shown by the dotted lines *G*. After the operator has put another part in position at *A*, he swings the lever from the *I* to the *H* position, which causes roll *J* to ride up the surface *K*, and swings clamp *D* downward about pin *F* until the clamp engages the work and securely holds it in place.

This method of clamping is only applicable to finished work, as the toggle action of the link and lever at *M*, together with the roll and clamp action, always locates the clamp in a definite position. A slight taper on surface *R*, however, is permissible to insure clamping within the variations usually found on finished work.

* * *

THE WESTINGHOUSE LIGHTING INSTITUTE

A permanent exhibit showing the application of electric light to all phases of life, commerce, and industry, has been opened by the Westinghouse Lamp Co. on the seventh floor of the Grand Central Palace in New York City. The exhibit is known as the Westinghouse Lighting Institute. This institute has been founded for the benefit of the electrical and other industries as a place where their representatives may come to have their lighting problems solved.



Lever-operated Wide-opening Clamp which Acts Horizontally and Vertically against Work

Current Editorial Comment

In the Machine-building and Kindred Industries

ECONOMIC INDUSTRIAL CHANGES

An important investigation into the changes that have taken place in American industry since 1922 has been concluded by the Committee on Recent Economic Changes, of which President Hoover is chairman. This report was first presented before the National Conference of Business Paper Editors in Washington a few weeks ago. It will be published in two volumes, which will contain a great variety of information relating to almost every phase of industrial activity. The complete report will present a record of the forces that have been at work in the last seven years to stabilize industry, increase wages, reduce costs, improve working and living conditions and add to the general well-being and comfort of the entire nation.

The report does not assume to predict future trends. It is concerned with specific statements of what has been and is being accomplished in American industry, and furnishes significant figures showing how improved industrial equipment and management methods have increased production in a ratio greater than that of any previous seven-year period. It is significant that during these epochal years there have been fewer labor disturbances than during any other period in American industrial history. Labor has felt that it has shared in the general prosperity and has aided in the general increase of efficiency. All executives will find valuable information in this report to aid them in charting the future course of their business.

* * *

MACHINERY EXPORTS ARE INCREASING

The exports of industrial machinery from the United States during March, the last month for which complete statistics are available, were valued at over $25,000,000—the greatest volume recorded since 1920. Practically a million dollars worth of industrial machinery left the United States for foreign countries every working day. The increase in the machinery exports in the last seven years has been noteworthy; in 1922 they were valued at about $9,000,000 a month; this rose to $13,000,000 in 1926, and to $17,500,000 in 1928.

Industrial machinery is defined by the Department of Commerce as machinery used in factories of all kinds, in mines and for engineering construction, but does not include locomotives and railroad cars, automobiles, trucks, tractors, agricultural machinery, and machinery and equipment for offices and domestic use; nor does it include electrical machinery and equipment.

The exports of metal-working machinery, classed as a subdivision of industrial machinery, have also increased steadily. At the present time, metal-working machinery to a value of nearly $4,000,000 is exported every month.

These tremendous exports of industrial machinery from the United States will have a marked influence on the wages and the standard of living in other parts of the world, because the introduction of industrial machinery is always followed by an improvement in living conditions.

* * *

AVOIDING BALL BEARING TROUBLES

In this number of MACHINERY is published the last of three articles on "What Causes Ball Bearing Troubles?" It is pointed out in these articles that most ball bearing troubles are caused by the failure of the user to follow the directions for mounting and care that are furnished by the ball bearing manufacturer. These directions explain exactly what to do and what to avoid doing in order that ball bearings may function at maximum efficiency and give long and satisfactory service. But the complaints received by manufacturers indicate that many users do not take the time to read these directions carefully, and when one of the rings cracks in mounting, or other difficulties develop, it is assumed that the bearing is defective. This creates a serious problem for the manufacturer, whose product left his plant in perfect condition.

If users of ball bearings will study the directions sent them by the manufacturer, and see that all shop men employed in mounting and caring for ball bearings are carefully instructed in handling such work, their ball bearings generally will last almost indefinitely; but careless handling may ruin a perfect bearing even before the machine in which it is mounted has been placed in service.

* * *

JUDGMENT IN USING HIGH-SPEED STEEL

Many draftsmen and shop men seem to believe that because high-speed steel gives such excellent results in heavy metal cutting it is a superior material to use for all kinds of cutting tools, as well as for machine parts subjected to wear. This is erroneous, because when for some reason cutting speeds must be low, carbon tool steel will frequently serve the purpose better at less cost; and other alloy steels not in the high-speed steel class often show greater resistance to wear. For example, low-tungsten tool steel is a better material for many kinds of power press dies than a high-speed steel.

The chief value of high-speed steel is that it will continue to cut metals effectively even after the tool has become heated to a temperature that would destroy a carbon steel tool; but there are many conditions where this property of the steel is not required and where cheaper steels, therefore, would serve the purpose better. Because a material is expensive it is not always the best for every purpose, and judgment must be used in determining in each case which kind of steel to select.

The New Era in Industrial Management

A New Sense of Responsibility on the Part of Both Employer and Employe has Ushered in a New Relationship in Industry

By CHARLES M. SCHWAB, Chairman of the Board
Bethlehem Steel Corporation

ON many occasions I have expressed the opinion that no enterprise is successfully managed unless it achieves, in addition to commercial success, the happiness and well-being of those who labor in that industrial undertaking. I have been asked to set down some of my ideas of how a relationship between employer and employe can be established that will accomplish this twofold purpose. There is no subject pertaining to industry that interests me more. In my career of nearly fifty years in business, it has given me real personal satisfaction to participate in the unfolding of a finer conception of the relationship between those who manage and those who labor. Whatever else I may have achieved, my participation in this endeavor has given me the most lasting satisfaction.

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Charles M. Schwab, Chairman of the Board, Bethlehem Steel Corporation

I believe that we will all agree that at no other time or in no other part of the world have the relations between employer and employe been as sound and, in general, as satisfactory as they are in America today. No people in the world are as free from class feeling as the American people. I have passed through some rather dark chapters in American industrial history, and it is a great joy to me to realize that a different spirit rules today—that industry has awakened to the fact that the employer, in engaging a man's services, is entitled to use them, but not to abuse them. We have come to recognize that the employe has rights, as well as the employer, and that among those are included the right to work safely and to live in such a way that he and his family shall have their full measure of security, health, and happiness.

Management has emerged from the plane of the old feudal conception and now recognizes that any industrial system worthy of our present age must enable men to live on an increasingly higher plane, must help them to satisfy their reasonable wants, and, in addition, must give them that feeling of security which is essential to contentment and efficiency.

What then, are these reasonable wants that men have a right to expect in as far as the conditions of industry will permit? My long experience in industry has brought me to the conclusion that there are six fundamentals that successful management must be able to achieve, namely: (1) The payment of fair wages for efficient services; (2) steady, uninterrupted employment; (3) good physical working conditions, including the safeguarding of lives and health; (4) a voice in the regulation of the conditions under which men work; (5) provision for savings and an opportunity to become co-partners in the industry in which they work; and (6) some guarantee of financial independence in old age.

I believe that with fair wages, steady employment, a financial interest in the business in which he works, a means of contact and cooperation with the management, and reasonable security for his old age, the worker has secured the fulfilment of the most important of his needs and wants.

The improvement in working conditions in the last thirty years reflects credit alike upon management and men, for this has been essentially a cooperative movement. The maintenance of healthy working conditions and accident prevention is a joint responsibility of employers and employes. It cannot be successfully accomplished without the enthusiastic support of both. In this connection, let me say that it is a source of real satisfaction to me that the steel industry, as a whole, has played an important part as a pioneer in providing safe working conditions, and I would add that it does not detract in any way from the broad humanita-

rian aspects of this work to consider its economic aspects as well, for accident prevention has maintained purchasing power, safeguarded steady employment, and kept the wheels of industry moving.

It is the Buying Power of the American Worker that Keeps the Wheels of Industry Moving

This leads to another important discovery that the business men of America seem to have made only recently—a new measure of appraisal of the American worker under present-day economic conditions. We have come to recognize that he is more than a producer; he constitutes the very backbone of our large-scale consumption. Steady employment at good wages is the cornerstone of active consumption, which means steady production. We can pay high wages in America because we are able to produce economically and efficiently on a large scale, but we are able to produce on a large scale only because high wages and permanent employment provide a market for the goods that are produced.

A Successful Organization is Built by Encouragement Rather than by Criticism

Whenever I mention the subject of friendly relations between employer and employes, I feel it necessary to repeat what I have so often said before, that no matter how great or how small a position a man holds in the scheme of industry, he can do better work under the spur of encouragement than under the lash of criticism. Experience has taught that industry's most important task under present-day conditions is the management of men. Machinery and buildings can be duplicated at short notice, but an organization of trained, conscientious, and happy workers cannot be built up over night. The manager who builds for the future will consider men first and material property second. With an enthusiastic organization he will succeed in any reasonable enterprise upon which he embarks. Without it, he is almost certain, sooner or later, to fail, and usually he will not understand why he failed.

In America today, the permanency of our institutions and our progress do not depend mainly on those who are socially or economically most prominent. On the contrary, I believe that the real bulwarks of our institutions are the men and women in the everyday walks of life, who by their industry, their thrift, and their good common sense act as the nation's balance wheel. The great industrial progress of America is due not so much to economic advantages, as to the good will that exists between those who are engaged in our industries, both as managers and wage earners. This, I believe, is the real secret of American industrial supremacy.

American Workers Want Good Leadership and Respond to it Generously

When we come to the point where we believe that those with whom we deal have just as human motives as we have ourselves, then we have laid the foundation for real industrial cooperation. In fostering relations of good will, our industry has greatly simplified its problems. Management is gradually coming to understand that, on the whole, labor meets good will with good will, respect with respect. American workers want good leadership, and it has been my observation that they respond to it generously, but they are also quick to observe when leadership for the common good is lacking.

The employer or manager of today who is in harmony with the demands of the times regards himself not as a mere owner, but as a trustee striving to guide the efforts of both capital and labor into profitable channels. I believe that the greatest achievements of the future lie in a still further development of this type of leadership in industry.

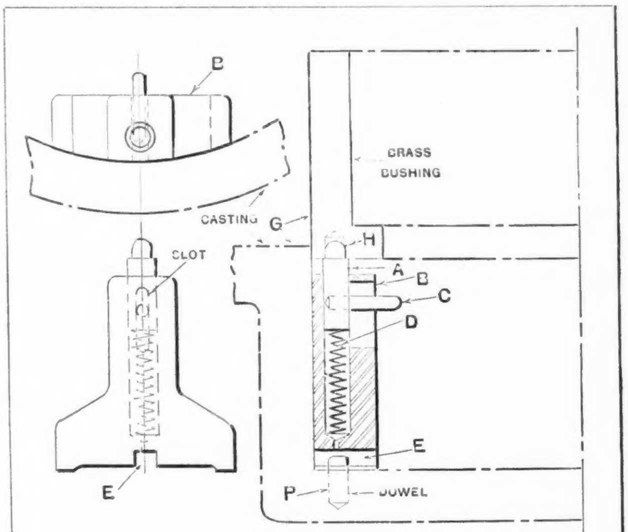
It is that kind of leadership that will hasten the day when we shall cease to talk about the conflicting interests of labor and capital and begin to think of ourselves as partners in a cooperative undertaking in the advancement of which every supervisor and every employe is an essential factor. In any business where that kind of spirit is established, success is certain.

* * *

GAGE FOR LINING UP DOWEL-HOLES

By JOSEPH E. FENNO

The gage illustrated is used for lining up the dowel-pin *P* in the casting, with the blind hole *H* in the brass bushing. The bushing is a press fit in the casting. Previous to the adoption of the gage, the parts were lined up by means of lines scribed



Method of Aligning Dowel in Casting with Hole in Bushing

at *G*. The gage *B* eliminates the necessity of laying out and scribing these lines. In lining up the parts, the gage is simply placed on the bottom of the casting bore with the slot *E* over the dowel-pin *P*, as shown. The bushing is then started by hand, being turned around until the plunger *A* enters the hole *H*.

In removing the gage, the finger-pin *C* is pressed down until the end of plunger *A* clears the bushing. After being located in this manner, the bushing is forced into place on an arbor press. The construction of the gage is shown quite clearly by the illustration and requires little explanation. The slot *E* is a slip fit over the sides of the dowel-pin, and is also central with the plunger *A*.

Recent Economic Changes in Industry

Summary of a Comprehensive Report by the Committee on Recent Economic Changes, of which President Hoover is Chairman

THE Committee on Recent Economic Changes was appointed in January, 1928, to make a survey of the economic and industrial situation in the United States during the years 1922 to 1927. In preparing its report, the Committee has been assisted by the National Bureau of Economic Research, formed in 1920 to conduct impartial examinations of facts bearing on American economic, industrial, and social problems. On the directorate of this Bureau are the heads of leading universities, financiers, and other business leaders, labor union leaders, and authorities on the agricultural situation. The report, therefore, may be considered one of the most far-reaching and impartial presentations of facts relating to industrial conditions that has ever been made in this country.

Underlying Causes of American Industrial Achievements

During the last six or seven years there has been a new "discovery of America" by foreign industrial leaders, engineers, and writers on economic subjects. Singly and in groups, these observers, representing governmental and private bodies, have studied America's progress and recorded a mass of information, much of which is controversial, but which has running through it a thread of agreement on certain factors responsible for American industrial world leadership. These outstanding factors may be summarized as follows:

1. Unrivaled natural resources, and the energy and organization by means of which they are utilized.
2. Relative scarcity of labor and prevailing high wages.
3. Constant development of machinery to perform tasks formerly done by manual labor or by less efficient machine equipment.
4. A tremendously large domestic market, which makes possible mass production.
5. Great rewards available to men having managing and organizing ability.
6. Improved industrial relations and recognition by labor unions of the mutuality of interest of employer and employe.
7. Open-mindedness of American management, and cooperation between industrial corporations through trade organizations, engineering societies, and chambers of commerce.
8. The dominant national trait of optimism and energy, and the mobility of the individual, both as to the place where he works and the calling in which he engages.

One of the noticeable developments in industry observed by the Committee on Recent Economic Changes is that definite planning, based on facts, is replacing the chance-taking type of management based on a "hunch"—so often misnamed "judgment"—that characterized industry in the past. There is today a systematic effort to learn from experience and to base judgment upon actual past records. An increasing number of business men are encouraging the keeping of better statistical data, to be analyzed as a guide in future planning. Probably there has been no greater advance in any branch of the field of management than in the attitude of men of affairs toward securing exact information based on statistical facts.

Other Important Factors in Our Industrial Development

Less fundamental, perhaps, but at the present time no less active causes of the unusual development that has taken place within the last few years are the unprecedented utilization of power, and the wide employment of automobiles, trucks, and tractors in business and industry. There is also a new professional spirit in business which recognizes a social responsibility that was formerly submerged in a, perhaps, too highly cherished individuality.

With the general increase in wealth there has been an increasing tendency toward the participation of the worker in the ownership of industrial undertakings and in sharing with management the responsibility for working conditions. There has been, also, during the period covered by this research, a great corporate development of business enterprise, and apparently a new public and official attitude toward this development—an appreciation of the services that great industrial undertakings are able to render when properly managed.

A New Evaluation of the Study of Human Relations

There is little need in a journal like MACHINERY to call attention, in detail, to the technical advances that have taken place during the period covered by this report. In the last few years, science has been applied in industry to a degree never before known in any country. However, the effort to apply scientific methods to industry may be considered one of the earlier phases in an economic development. If the nation is to benefit fully from the engineering and technical advances, there are other sciences that must also be thoroughly studied and understood—psychology, sociology, and economics. In these, far less advance has been made than in physics and chemistry.

The men who are now applying these sciences—personnel managers, advertising specialists, sales directors, business economists, and statisticians—are less thoroughly trained than engineers. It is also much more difficult to measure the results achieved by these men than to determine what difference a new machine makes in unit costs; nor are business executives in general as fully convinced of the practical value of the rather intangible services that the new professions render. They do not consider them as indispensable as engineering advice; yet, it is conceivable that the applications of social sciences, now in their tentative

stage, will prove extremely valuable to the economic welfare of the nation.

Perhaps none of the changes that have taken place in the general attitude of mind will prove more important in the long run than the change in the economic theories on which the American Federation of Labor and certain outside unions are acting. Not only is there a tendency to show a grasp of the relations between productivity and wages, and to take an initiative in pressing constructive plans for increasing efficiency upon employers; but, in some instances, these ideas have been spread with such vigor as to startle those who believe that trade unions can act only as brakes upon economic progress.

A New Era in Business Management

Scarcely less significant is what the report has to say of employers and business management. The investigators feel that the art of management turned a corner in 1921, and that since then a clearer understanding of the whole industrial and labor situation has been in evidence. Many corporations and trade associations are maintaining research bureaus. Responsible staffs are more and more taking the place of one "big boss." Bonus payments for executives and "incentive wages" for the rank and file, operating budgets, forecasts of business conditions, close inventory control, personnel management, and employe representation are among the developments in management that have been given much attention.

Less business secrecy exists today than ever before. There is more publicity concerning business operations and a closer cooperation between firms engaged in the same line of business. The old rule of secretiveness and the idea that the individual concern ought to be "all things unto itself" is beginning to pass away. The growth of trade associations is the clearest evidence of this new attitude of business. To be sure, in every industry there are those who refuse to play on the team, but all in all, there is a marked increase in the readiness to join in furthering cooperative methods; to interchange trade information; to standardize products—briefly, to treat the industry in many respects as a unit, in the prosperity of which all members have an interest.

Attempts are being made to understand and utilize the psychological forces that control human behavior and the economic forces that control business activity. There is today not only more production per man, more wages per man, and more mechanical horsepower per man, but also more management per man.

Even marketing—traditionally the part of business in which native shrewdness, experience, and personal magnetism have been held to be all important—is being reduced to a matter of facts, records, and applied psychology. Costly investigations of "consumer appeal," of "advertising pull," of "sales resistance"—the very terms would have been unintelligible thirty years ago—show that sales managers are trying to base their work on studies of facts.

Facts Instead of Guesses Guide Present-day Business Planning

Another marked development is the spread of cautious planning which utilizes facts. This type of planning is replacing the chance-taking that was based on a "hunch," so often misnamed "judgment." This spread of caution is manifested in hand-to-mouth buying in industry, and in the keeping down of inventories and stocks of finished goods. Along with this caution has come a more systematic effort to learn from experience—to base judgment on actual past records. There has been an increasing number of business men who are encouraging the keeping of better statistical records, to be analyzed as a guide to future planning. The remarkable report presented by President Hoover's committee, which contains a vast volume of statistical information, would not have been possible without the aid of these new business statistics.

More publicity concerning business operations, closer cooperation between business enterprises, and less business secrecy should also be noted as characteristic of the day. These are features of American industry that impress all foreign visitors. The old rule of secretiveness and individual rivalry seems to have maintained itself more rigidly in other countries.

The growth of trade associations is the clearest evidence of this new attitude of business. To be sure, every industry has in it those who for one reason or another refuse to play on the team, but all in all, there is a marked increase in the readiness to join in furthering cooperative methods, to interchange trade information, to standardize products, and to exchange information about methods and practices—briefly, to treat the industry in many respects as a unit in the prosperity of which all members have a common interest.

The Interdependence of High Wages and High Production is Recognized as Never Before

The belief that high wages are good for the stability and earning power of business has become as prevalent among the abler business executives as has the belief, among the abler trade union leaders, that increasing productivity is a means toward bettering the conditions of labor. Far-seeing manufacturers realize that to make goods cheaply and profitably by mass production methods, there must be a correspondingly great purchasing power on the part of the majority of the population; and studies of the national income have demonstrated that wages constitute by far the largest share of personal income. Hence, if wages per man or per family can be increased, production can be expanded. Today leading business executives not only admit the general principle that paying high wages is good policy, but are also ready to assume what they consider their share of the responsibility of putting the principle into practice.

The Government's Share in the Improved Industrial Situation

The federal government has of late years manifested a more intelligent attitude toward the prob-

lem of economic organization. While this policy may not have become characteristic of the government in all its dealings with business, any more than the doctrine of high wages is accepted by all employers, or the theory of the benefit of increased productivity is accepted by all trade unionists, nevertheless, no one who has watched the federal government's policy as practiced by many of its agencies will question that a change has occurred. More regularly than in the past, the efforts of the government are directed toward increasing the efficiency and facilitating the operation of legitimate enterprises.

What of the "Profitless Prosperity" of Recent Years?

"The expression, 'Profitless prosperity,' like so many other popular paradoxes," says the report, "combines an element of truth with an element of falsehood." It is to be expected in a period of unusually rapid increase in efficiency that there would be more than usual inequalities in profits. This has been borne out by the experience of the years 1922 to 1927. Whether the enterprises which have lagged behind in cost reduction and in earnings are merely the smaller enterprises, as has been contended, is, however, not certain.

This contention may have a tendency to become true with a lapse of time for the simple reason that profitable enterprises usually grow faster than those less profitable, so that the profitable enterprises of today tend to become the large enterprises of tomorrow, while the small enterprises of today that are not profitable remain small. The chapter on industry in the report, however, shows that there is no close relationship between large size and low unit cost, or between large size and high rates of profit. It seems, rather, to be the medium-sized enterprise that has felt the economic pressure most severely.

Able business executives today recognize that high wages are necessary for the stability and earning power of business. Able trade union leaders are also recognizing that increased productivity is a means toward better conditions for labor. It is becoming more and more thoroughly understood that to make goods cheaply and profitably by mass production methods, requires a corresponding increase in the purchasing power of the great mass of the population. Hence, if wages per man or per family can be increased, production can be expanded. Many leading business executives today have accepted this principle and are ready to assume what they consider their share of the responsibility of applying the high-wage-high-production policy in practice.

Does Increased Industrial Efficiency Cause Unemployment?

Among the hardships alleged to be due to increased industrial efficiency, the decline in the number of wage earners employed by the factories throughout the country has been given the most publicity. To this phase special attention has been paid in the investigation.

There is nothing new in the belief that machinery causes unemployment. It will be readily granted that the application of labor-saving machinery may cause a temporary reduction in employment in a certain industry. Nevertheless, it is obvious that the broad results of the introduction of machinery into the industries, both during the past century and during more recent years, have been a material increase in the demand for labor and in the wages paid to labor. Labor-saving machinery has turned out to be in reality job-making machinery.

To recall these familiar facts does not, however, diminish the hardship of those who are temporarily thrown out of employment through the increased efficiency of industry, and one of the problems that the future may have to face is to provide a simple method of finding satisfactory employment in some other line of activity for those who, due to improved engineering methods in one industry, become superfluous in that field.

The Business Cycles in Recent Years

One of the most significant features of industrial activity in the period 1922 to 1928 has been the narrow range of fluctuations in economic activity. Business cycles have not ceased to run their course, but the difference between peak and valley has been much less marked than formerly.

It is not the task of this report to forecast the future, but it is mentioned that the freedom from severe fluctuations during recent years offers no guarantee that the business years just ahead will be equally calm. It is quite possible that the expansion which has just about now reached its peak will pursue a moderate course and recede quietly; but if that is to happen, business men must maintain the same prudent policies that they have adopted during more recent years, stocks must be kept in line with current sales, and over-commitments of any kind must be avoided. We have maintained a well balanced system in recent years, and prudence and common sense will probably enable us to continue to maintain this balance.

More Common Sense has been Applied to Industry than Ever Before

If one were to summarize briefly the main underlying currents in industry during the last five or six years, one might say that there has been an increased effort to apply intelligence to the day's work. More common sense has been applied to industry in recent years than ever before. Chance and luck have more and more given place to carefully laid plans and knowledge of predetermined facts.

Looking ahead, it is impossible to say whether the recent rate of progress in industry and business can be maintained. Experience suggests that the pace will slacken temporarily and that years may go by before we will again see a similar pace adopted, but this is a matter in which experience is not a trustworthy guide. "The only thing that is certain," concludes the report, "is that whatever progress in efficiency we continue to make must be earned by the same type of bold and intelligent work that has won our recent success."

Special Tools and Devices for Railway Shops

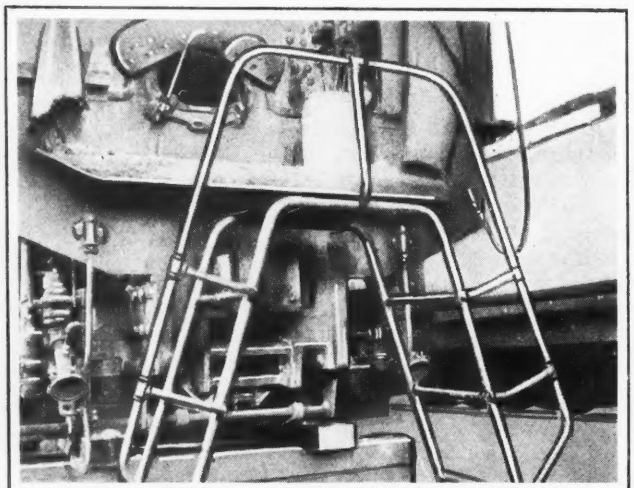
Equipment Employed in Locomotive Repair Shops, Selected by Railway Shop Superintendents and Foremen as Good Examples of Labor-saving Devices

LOCOMOTIVE ERECTION SHOP PLATFORM

By H. H. HENSON, Foreman, Machine and Erecting Shop, Southern Railway Co.

A platform made of 1 1/4-inch and 2-inch pipe welded together makes a rigid scaffold for use in an erection shop repairing locomotives. One that has been found suitable is shown in the accompanying illustration. With it the workman can conveniently get around a large locomotive to install running-board brackets and other parts that cannot be reached from the floor.

This scaffold can be placed at the boiler head of a locomotive, and will be found very useful in getting up on the back of the cab floor after the cab and all grab irons and step castings have been removed. The platform of the scaffold illustrated is



A Platform Scaffold Used in a Locomotive Repair Shop

made of a piece of 1/4-inch boiler plate, about 26 inches square. The height of the platform from the floor is about 60 inches. It will be noted that there are three steps on each side suitably spaced. The hand-rail extends about 22 inches above the platform.

JIG FOR SPACING LUBRICATING HOLES IN LOCOMOTIVE AXLE BUSHINGS

A drill jig for spacing the lubricating holes in floating side-rod and axle bushings, such as are frequently used on modern locomotives, is shown in Figs. 1 and 2. The bushings, one of which is shown at *A*, Fig. 1, as it appears after drilling and countersinking, are made in different sizes and with different spacing of the holes. With the jig shown, any desired longitudinal and circumferential spacing of the oil-holes may be had by adjusting the stop-screws *B* and *C*, Fig. 2, by means of which the throw of the two indexing levers *E* and *F* is regulated.

The bushing to be drilled is placed in the V-groove of the slide *G*. If a single-spindle drill is

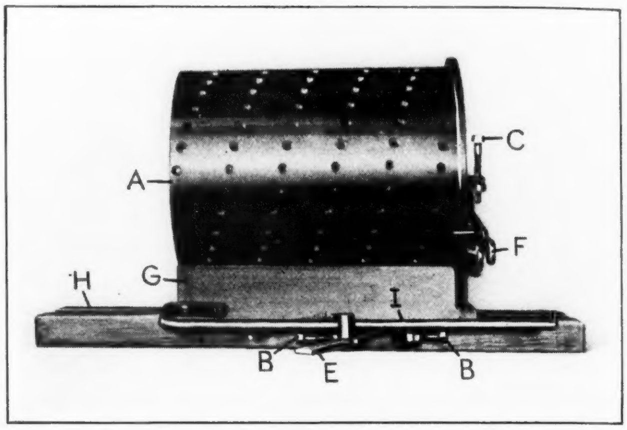


Fig. 1. Locomotive Axle Bushing Mounted on Indexing Jig Used in Drilling Lubricating Holes

used, slide *G* is located at the left end of the base *H* in the correct position for drilling the first hole at the right-hand end of the bushing. After drilling the first hole, the operator simply pulls the lever *E* to the right until it strikes stop *B*. This causes slide *G* to move to the right into the proper position for drilling the second hole.

Lever *E* is equipped with a ratchet or clutch which grips rod *I* on the indexing stroke. On the return stroke this clutch allows lever *E* to be returned to its original position in contact with the stop-screw *B* at the left without moving slide *G*. This simple method of spacing is repeated until all the holes in one row have been drilled.

When a multiple-spindle drill is used, which drills one complete row of holes at a time, lever *E* is adjusted for a short stroke and used to advance the work the amount necessary to give the helical arrangement required. When one row of holes has been drilled, the lever *F* is raised to index the work the proper amount for drilling the next row of holes. WEBB

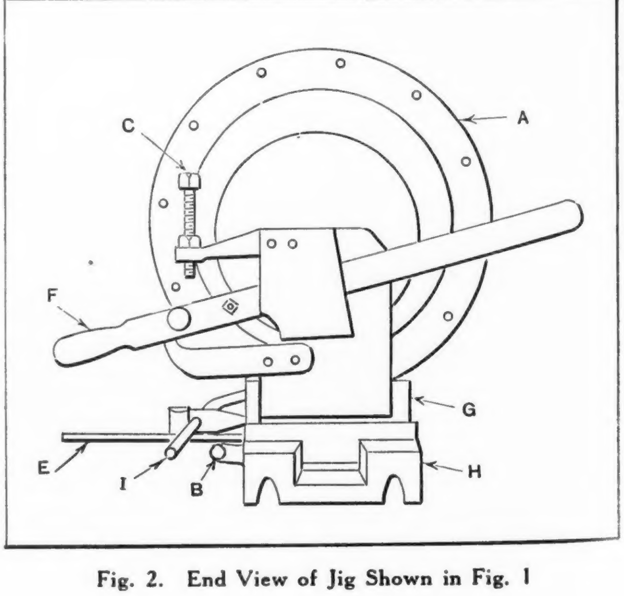


Fig. 2. End View of Jig Shown in Fig. 1

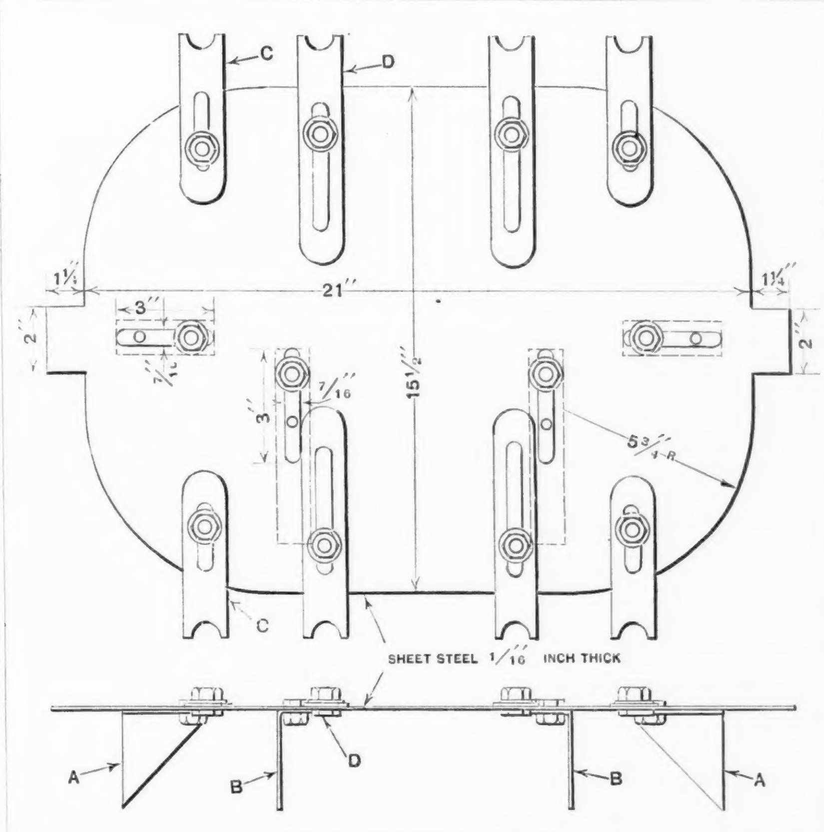


Fig. 1. Templet for Drilling Fire Door Frames

DRILLING FIRE DOOR FRAMES

By E. A. LOTZ
Foreman, P. R. R. E. & M. Shops, Juniata, Pa.

An adjustable templet for laying out the holes to be drilled in fire door frames of locomotive fire-boxes is shown in Fig. 1. This templet is placed over the door hole in the back head of the firebox, with the angle pieces *A* and *B* set out against the edge of the door, after which the eight slidable locating pieces *C* are adjusted to engage each stud in the back head sheet.

The templet thus adjusted is then laid on the fire door frame with the angle-pieces *B* moved toward the center of the templet a distance equal to the thickness of the lap portion of the frame, which extends over the bottom surface of the door hole when it is in position on the fire-box. The position of the stud holes to be drilled can then be easily scribed on the frame, using the ends of the members *C* as guides.

This method of locating the holes eliminates drilling over-size holes or the bending of studs when applying frames in the usual way. The new method of handling frames has effected a saving in time of about 80 per cent over the old method, which necessitated carrying the frames to and from the erecting shops. The frames are now drilled, fitted, and finished complete, ready for application in the repair section of the machine shop. Details of the adjustable pieces *C*, the angle-pieces *A* and *B*, clamping studs *D*, and the wrench for use with the templet are shown in Fig. 2.

* * *

In an address before the National Supply and Machinery Distributors Association, H. C. Dunn of the Bureau of Foreign and Domestic Commerce, pointed out that distribution, to be efficient, must be based on the same type of scientific research as production. He quoted some research work that had been done in this field, showing particularly that greater profits can often be made by handling a smaller volume of business, because very frequently the last 10 or 20 per cent of the volume is obtained at an excessive cost. Manufacturers and distributors alike, should study their sales and should not be satisfied to know merely that they have made a profit at the end of the year, but should find out on which items, and in dealing with which customers, they have actually made a profit. As far as possible, then, unprofitable items and unprofitable customers could be eliminated.

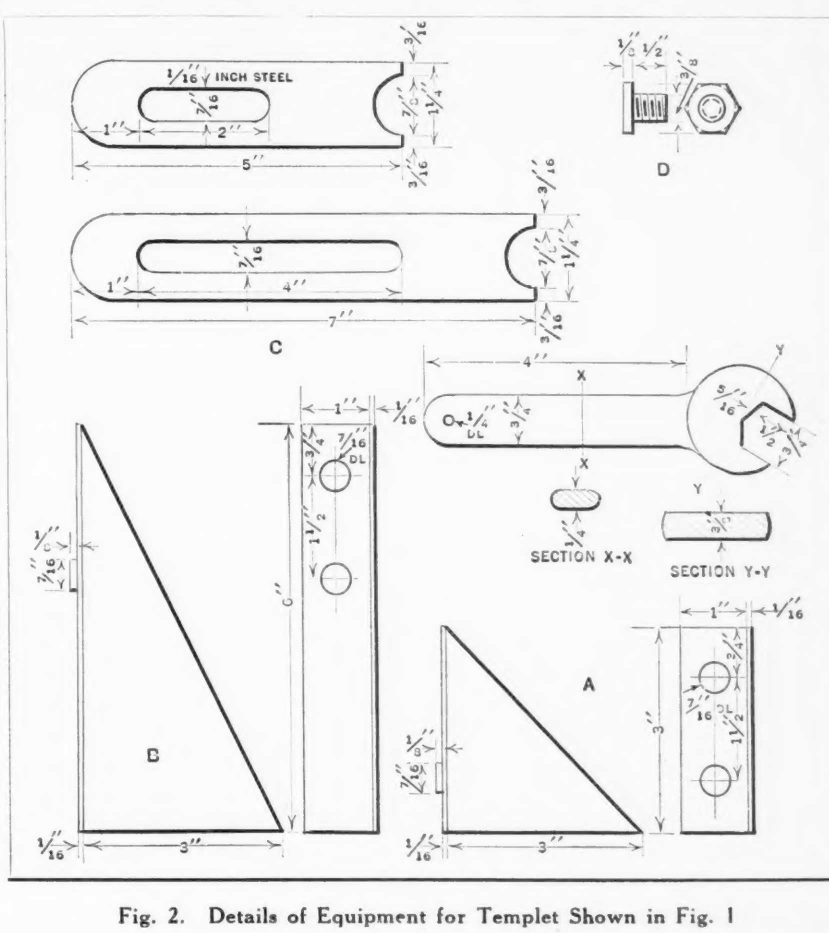


Fig. 2. Details of Equipment for Templet Shown in Fig. 1

What Causes Ball Bearing Troubles?

Most Troubles with Ball Bearings Are Caused by not Following the Directions Given by the Bearing Manufacturer

By ASHER GOLDEN, R B F Ball Bearing Co., New York City

IN the articles published in April and May MACHINERY, the author pointed out that the directions for mounting and applying ball bearings furnished by the manufacturers are not so carefully followed by users of bearings as they should be. A number of alleged defects in ball bearings that the user believes to be the cause of his troubles have been dealt with. In this, the concluding article, additional troubles with bearings claimed to be due to defects will be reviewed.

Troubles Due to Tight Bearings

We now come to another common "defect"—that of tightness of bearings—that is, lack of freedom of the two rings to rotate with respect to each other. As mentioned in a previous article, before a high-grade bearing comes into the hands of the ultimate consumer, it is subjected to every possible test and inspection. One of these tests consists of rotating it rapidly for a short time to assure freedom of motion. This is usually done before the greasing operation. Hence, when a bearing is tried just as it comes out of the original wrapper and box, the two rings will be found to turn freely relative to each other; but for some reason unknown to the user, the bearing becomes tight either before it is mounted, directly after mounting, or after a short period of service; and as a result it is pronounced "defective."

A cause of tight ball bearings that frequently baffles the inexperienced mechanic is the mounting of bearings on over-size shafts or in under-size housings. If a bearing is forced on an over-size shaft, the ring expands slightly. If the bearing has initial radial play or a loose fit between the balls and the raceways, this expansion may not injure it; but if it is tightly fitted to begin with, in order to conform to the buyer's specifications, then there is no room for expansion, and the result is that the bearing will be tight, or even break.

Dirt is the Most Common Cause of Tight Bearings

There are several things that may cause a bearing to become tight. The most common is dirt. If you step into the store-rooms in the user's shop where the bearings are stocked, you will find in many of them that the bearings have been taken out of their boxes and the protective moisture-proof wrapping has been removed. Even the grease with which they are covered to prevent them from rusting has been washed off, and the bearings are allowed to lie in open bins and to accumulate dust and dirt just as if they were so much cast iron.

In other cases, proper care may be taken in the store-rooms. Bearings are passed out in their original wrappings and boxes to the mechanics, but instead of being kept in this condition until the very moment that they are to be mounted, the bearings are removed from the boxes and wrappings and permitted to lie around on the work-bench, or even on the floor of the shop, where they may accumulate dirt, metal filings, and chips.

One prominent bearing manufacturer gives this warning "Dirt means damage.—In replacing bearings, look out for dirt. Dirt is the greatest single enemy of the anti-friction bearing. Keep the bearing in its container until ready for use. Do not place it where dirt of any kind can get into the raceways."

Dirt in a bearing is generally spread out over the raceways by the rotating balls and may cause the bearing to become tight or do other damage. Keeping a bearing in its container until ready for use does not, however, give absolute assurance of freedom from this cause of failure. The housings into which bearings are installed should be perfectly clean to begin with, and all fins or flashes from which particles may be dislodged should be removed or smoothed down. Moreover, clean lubricant should be used, and it should be kept clean.

Several years ago a number of bearings were returned by one of the large motor car manufacturers as being tight. Some of them were so tight that they had become blue from the heat developed while in operation. When they were examined, the raceways were found to be covered with a thin layer of bronze and aluminum. The bearings were of the so-called "full" type, that is, without retainers—nothing but two rings and a row of balls—so that this metal covering on the raceways could have come from no other place than the transmission case in which they were housed.

Mounting a Bearing on Too Large a Shaft or in Too Small a Housing May Cause Tightness

Another cause of tightness that mystifies the inexperienced mechanic is due to mounting bearings on over-size shafts or in under-size housings. The effect is the same, so it will be sufficient to consider only the shaft. Forcing a bearing on an over-size shaft causes the ring to expand. The thicker the ring, the less it will expand, of course, when under the same pressure; there will be, nevertheless, an appreciable expansion no matter how thick the ring may be. If the bearing has initial radial play or a loose fit between the balls and the raceways, the expansion may be taken up without injury to the bearing; but if it is initially fitted tight, according to the specifications of users, as is often the case, then there is no room for expansion and the bearing may tighten up or break. Still another cause of tightness comes from ignorance of the proper way to mount a bearing. The proper method was pointed out in the previous article in this series. It has

also been shown that one of the improper methods is to force the bearing into place by means of a heavy hammer. Let us assume that the bearing is being mounted in this way. The mechanic hammers away until he makes it flush with the end of the spindle. The hammer can now no longer be applied without risk of striking and battering the end of the spindle, so the only thing to do now is either to continue to hammer on the outer ring, which the mechanic may realize is wrong, or grab a chisel or other auxiliary means and hammer on the inner ring.

Just recently three bearings of the same size were returned to a manufacturer and alleged to be tight and "defective." The mechanic did not realize that he had ill-treated the first bearing, and so continued to give the same treatment to the other two. The retainer of one of the bearings had a deep cut where the chisel had struck it, and the metal of the retainer was squashed down against the inner ring, preventing it from turning.

Causes of Noisy Bearings

There are several things that may cause a bearing to become noisy; the most common is dirt. How dirt gets into a bearing is no mystery, but it is not there when the bearing leaves the factory, and it is not there when it comes into the user's hands. It gets there through carelessness and negligence of the user. If the particles of dirt are easily crumbled or pulverized, they may be reduced to a state of harmlessness; but if the particles are of sand or hardened steel or other hard substances, they cut into the balls and raceways, no matter how hard these may be initially.

Noisy ball bearings are often due to the roughening of the surfaces of the balls and raceways caused by overloading. Many ball bearings are overloaded without the user realizing what is happening. Overloading is not always due to carrying a useful load beyond that for which the bearing is designed. It may also be caused by the bearing being forced on a shaft with excessive pressure, thereby expanding the ring and causing internal stresses which may be even greater than those that are caused by the normal running load.

A little while ago a user returned a bearing which he claimed was very rough and noisy, and, therefore, "defective." The bearing was washed out and found to contain a considerable quantity of sand and gravel, some of the grains of which were 1/16 inch in diameter.

In another case a bearing used on the crankshaft of a motor truck engine was returned. "Bearing defective; tight; please replace," were the simple words of complaint. When the bearing was inspected, the internal surfaces of the two rings, as well as the retainer, were found to be covered with a thick layer of dry carbon. In overhauling the engine, the mechanic evidently must have observed that there was no oil or insufficient oil in the crankcase and that the bearing must have been running dry for some time, but this he did not report to the bearing distributor. It was easier to claim that the bearing that had been running dry and was covered with a layer of carbon was "defective."

Overloading of Bearings May Cause Noisy Operation

A bearing may be run under practically ideal conditions, so far as cleanliness and clean lubricant are concerned, and yet it may become noisy in operation. This is invariably due to a roughening of the surfaces of the balls and raceways, a condition that may be brought about by overloading. It is a simple matter to diagnose a case of failure from this cause, but how a bearing can be overloaded is a most mysterious thing to the average user. When he turns in a bearing for inspection and is told by the manuafcturer that the bearing has been overloaded, he says, "Well, the bearing I had in there before was all right." He is quite sure that no greater loads than have always been carried have been imposed on the vehicle or machine from which the overloaded bearing has been removed.

This may be so. The bearing that was all right may have had a proper fit on the shaft and in the housing and had a chance to run under normal conditions. When the machine was overhauled and the bearing removed, the spindle may have suffered in a way already described in this series of articles or it may have been replaced by an entirely new spindle. If this spindle happens to be over-size, so that the bearing has had to be forced on by using excessive pressure, the rings may have expanded, as previously explained. This creates internal stresses in the rings which may be even greater than those caused by normal running loads; hence, a bearing may be overloaded even before it goes into service. Such a bearing may run for a while, but it is bound to break down and suffer a premature "death."

Causes of Broken Balls

The balls that go into bearings are put through a drop test in order to eliminate any that may be cracked or split. After the final polishing operation, they are inspected to detect scratches, flat spots, or other surface imperfections, as well as to detect any that may not be perfectly spherical. In spite of the care taken, there is a possibility that an imperfect ball may get through without detection. However, very few escape the watchful eye of the inspector. But if we were to base our judgment on the number of bearings that are pronounced "defective" because a ball breaks, then there must be a great many defective balls.

A ball may break because an instantaneous excessive load is imposed upon it. Let us see how this may happen. The vast majority of users have an idea that the load on a bearing is uniformly distributed over all the balls. This is not true in general, except of a thrust bearing against which the shaft or spindle sets squarely and which rests squarely on its seat. In a radial bearing, there is a point at which the load is maximum. At this point the ball sustains the maximum load and the balls on each side of this most heavily loaded ball carry less and less load as we recede from this ball. During a single revolution of the bearing every ball will, in turn, pass the point of maximum load. Now, it may happen that an excessive shock load, greater than the crushing load of the ball, may be imposed upon it. When such a load comes upon the ball, it will break.

A case in point is a recent experience with a double-row bearing in the rear wheels of a number

of trucks. The user complained that the bearings gave very unsatisfactory service. An investigation showed that the normal load on one bearing was 7 tons. The trucks are driven over very rough roads, where the wheels often drop as much as 6 inches. Practically the entire load, greatly increased by the drop, comes upon two balls, one in each wheel. The balls stand this rough service for a time and then break. Different makes of bearings have been tried in this situation. Some have stood the treatment a little longer than others, but all have failed in the same way.

Not very long ago a large bearing which had been used in a bus was returned, with a memorandum slip which read, "Bearing defective, made 7900 miles, please replace." The bearing was found to have suffered from severe overloading. The user was asked to submit a report on the date of installation, the length of time the bearing had been in service, and the mileage. The report showed a total distance covered of 29,700 miles, which may be considered a rather exceptional service for an overloaded bearing.

The Causes of Loose Bearings

Some time ago a user returned two bearings that had been removed from one machine. "Bearings defective, loose, in service less than three weeks," read the complaint. The balls of both bearings, as well as the retainers, were in perfect condition—that is, nothing was broken or chipped—but all the balls were found to be badly tarnished, having a very dull grayish color. The retainers of aluminum bronze, initially a bright golden color, were found to be discolored to a deep orange. Here clearly was a case where the balls and retainers were attacked by free acid in the lubricant, and the balls and raceways worn down by the combined action of impure lubricant and grit.

Now, there is a possibility that one bearing may go wrong in a certain machine and that the bearing may actually be defective; but that two bearings will go wrong at the same time in the same machine and both be defective, is a very remote probability.

What is the Remedy for "Defective" Bearings?

There is only one remedy for the conditions described in this article. If the user will not heed the bearing manufacturer's advice and directions, there is nothing for the manufacturer to do but to refuse to make a replacement whenever it is found that the bearings have been abused in any of the ways described.

One factor that tends to aggravate the condition is the manufacturer's desire to keep the good will of the user. He replaces the bearing without cost to the user—often without any comment. The user naturally assumes then that his complaint was justified and that his judgment of ball bearings has been vindicated.

Time of Oscillation in Helical Springs

Charts for Determining the Period of Vibration and the Damping Factor

By J. W. ROCKEFELLER, Jr., Consulting Engineer, New York City

IF a weight is allowed to fall upon a helical spring designed to serve as a buffer or shock absorber, the spring and its load will vibrate or oscillate for a time before coming to rest. The period of vibration, or the time in which the spring makes one complete oscillation, has a definite relationship to the amount the spring is deflected by the load, which consists of the weight imposed on the spring plus one-third the weight of the spring itself.

The chart Fig. 1 has been prepared for use in determining the period of vibration or the time of a complete oscillation T in a helical spring under conditions in which the damping effect of the load is disregarded and also under conditions where the damping is directly proportional to the velocity.

The heavy, straight, oblique line in Fig. 1 represents the relation between the static deflection of the spring under a moving load and the period of vibration or time of a complete oscillation, in seconds, when no damping effect is considered. For example, when the deflection of a spring under the moving load is 10 inches, the time of a complete oscillation is 1 second.

This is determined from the chart by locating the vertical line representing a deflection of 10 inches and following it upward to the point where it intersects the heavy oblique line. From this point the horizontal line is followed to the column at the extreme left-hand side of the table where we find the time T to be 1 second.

The chart Fig. 2 is used in determining the damping factor when the applied weight is known and the damping is directly proportional to the velocity of the vibrating or oscillating weight. The horizontal lines in this chart represent the magnitude of the moving load, which must be taken as the weight imposed upon the spring plus one-third the weight of the spring itself. The oblique lines represent the damping effect, in pounds, in terms of the velocity. Thus, where the oblique line equals 50, the damping effect upon the system at any instant will be $50V$ pounds; 50 pounds when the velocity is one foot per second; 100 pounds at a velocity of two feet per second, etc.

The vertical lines represent the damping factor H which is used in the chart Fig. 1 when taking the damping effect into consideration. If the weight, for example, is 8 pounds and the damping effect is $2V$ pounds, it will be seen from Fig. 2 that the damping factor H is approximately 16. Now if the spring previously referred to, which had a static deflection of 10 inches and a period of vibration or

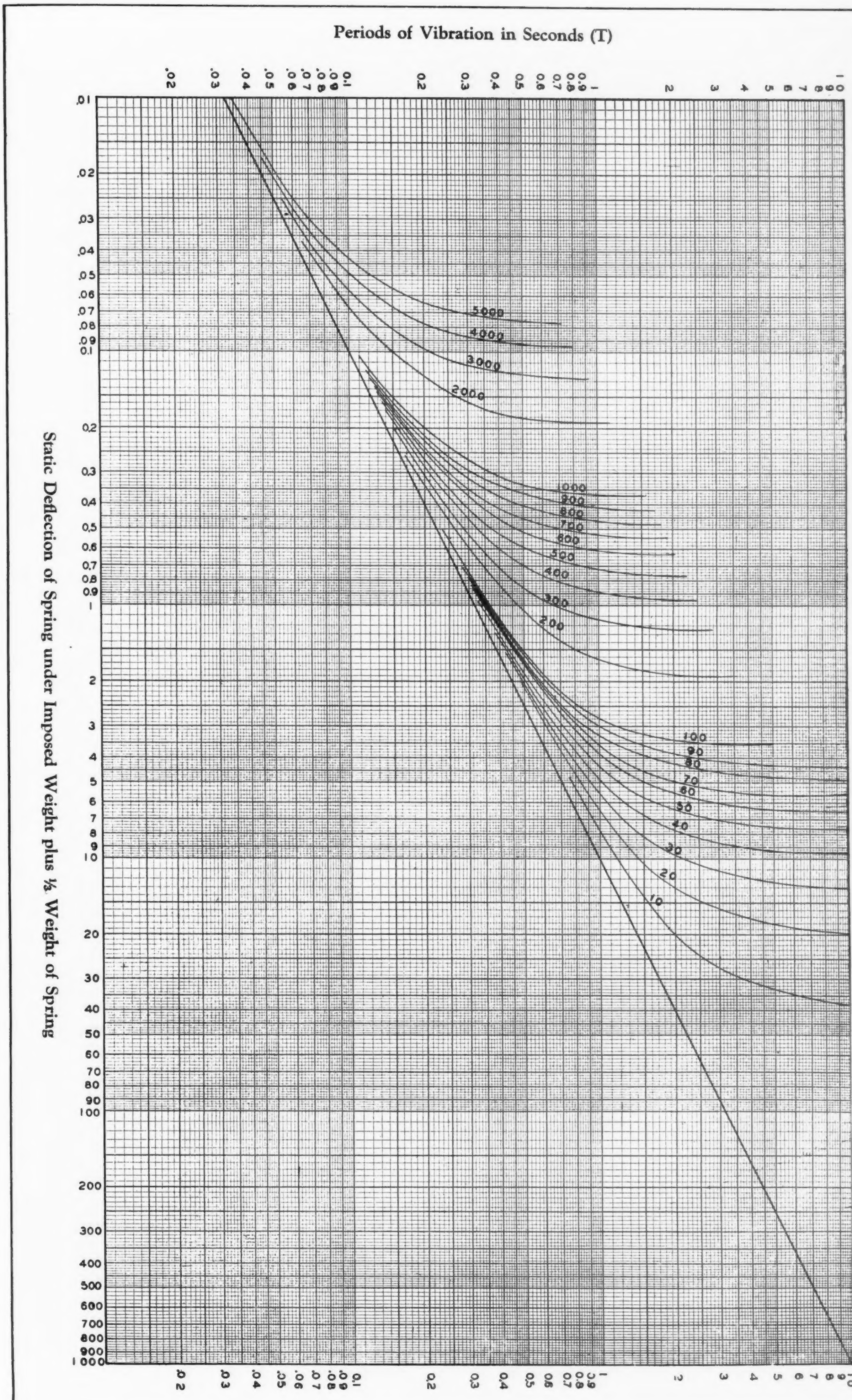


Fig. 1. Chart for Determining Time of Complete Oscillation in Helical Springs

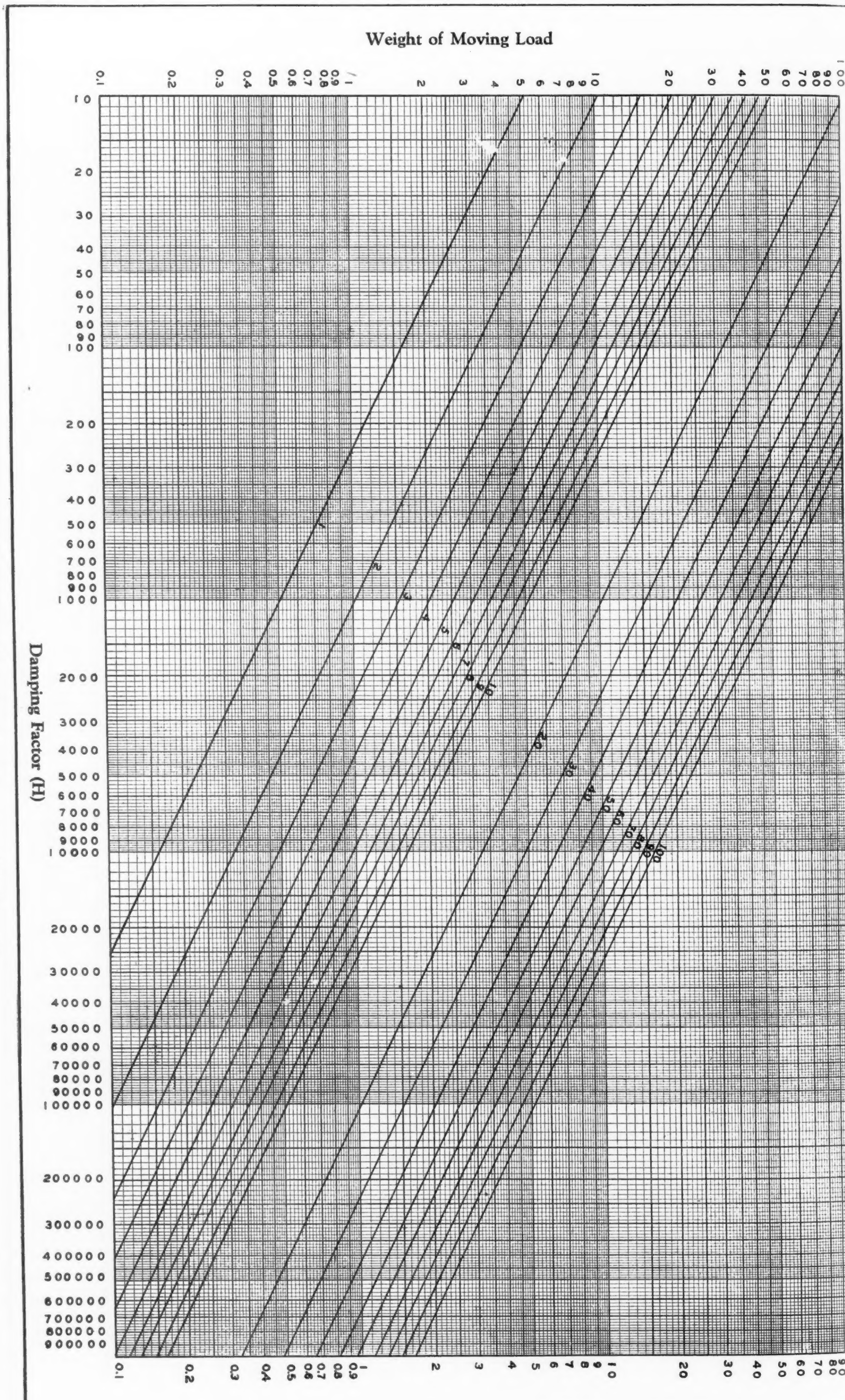


Fig. 2. Chart for Determining Damping Factor for Helical Springs

oscillation of 1 second, operates under conditions in which the damping factor is 16, the period of vibration would be 1.3 seconds instead of 1 second. In determining this value, the vertical line is followed upward beyond the point at which it intersects the oblique line to a point about midway between the curves representing damping factors of 10 and 20, respectively. From this point the horizontal line is followed to the left where the time of oscillation is found to be 1.3 seconds.

In some cases, the damping factor will be so great that there will be no intersection between the deflection line and the curve representing the damping factor. For example, in a case where the damping factor is 30 and the static deflection of the spring under the load is 20 inches, there will be no intersection between the two lines. This merely indicates that the damping effect is so great that the system will not make one complete oscillation.

Example—A compression helical spring is deflected 3.5 inches under a load of 6 pounds. The damping action on the system is $2V$ pounds. Find the time in which the spring makes one complete oscillation, taking into consideration the damping effect of the load.

Referring to Fig. 2, we locate the horizontal line representing a load of 6 pounds and follow this line to the right to the point where it intersects the oblique line representing a damping effect of $2V$ pounds. From this point we follow the vertical line downward to the bottom of the chart, where we find the damping factor $H = 30$.

Now locating the vertical line representing a deflection of 3.5 inches at the bottom of the chart Fig. 1, we follow this line upward to the point where it intersects the curve which represents a damping factor of 30. From this point we follow the horizontal line to the left-hand side of the table, where we find the time of one complete oscillation T to be 0.7 second.

* * *

LAPPING BRONZE AND BABBITT BEARINGS

By H. J. WILLS, Engineer, The Carborundum Co., Niagara Falls, N. Y.

It has been the usual practice, in the past, to finish plain bronze and babbitt bearings by hand scraping. This process requires considerable time and skill and seldom provides more than a 50 per cent metal-to-metal contact between the bearing and the shaft.

By means of recently introduced abrasive lapping compounds, it is possible to lap such bearings so that they will have a metal-to-metal contact of from 75 to 90 per cent. This means less subsequent "taking up" and longer life of the bearing. There is also a great deal of time saved by lapping, as compared with scraping. The time saved will vary according to the type of machine and bearing, but in general, the lapping can be done in from one-quarter to one-half the time required for scraping.

As a typical example of lapping, compared with scraping, take the taper bushing for a cylindrical grinding machine. The total shutdown time when this bushing was scraped was 55 hours. When it was lapped, it was only 18 hours. The accuracy obtainable in grinding when the spindle ran in lapped bearings was much greater than when it ran in scraped bearings. In this particular instance, the scraped bearings did not permit a grinding tolerance closer than 0.001 inch, while with lapped bearings, it was possible to obtain a tolerance in the work being ground of 0.0005 inch. The closer fitting of the lapped bearing on the spindle permits these closer working tolerances.

The lapped bearings did not heat as much as the scraped bearings, and only once during sixty operating days of 21 hours each, was it necessary to take up the lapped bearings. With scraped bearings, it has been found necessary to take them up at least three times during the same period.

In lapping split bearings of bronze or babbitt, the shaft or spindle is first removed and the bushing loosened. An abrasive finishing compound (Carborundum Brand grading HR2-40 would be the right quality to use) is then applied liberally to the bushing and shaft. After replacing the shaft in the bearing, the bushings should be tightened until a very light drag is felt on the shaft when turned by hand. The shaft is then turned and oscillated by hand, or it may be driven by power at a speed not exceeding 200 revolutions per minute. The bushings should be kept tightened to a light contact during the lapping process.

The time necessary for this operation will depend on the type of bearing, the composition of the metal, and the surface contact desired. When the bearing shows good contact with the shaft, which can only be determined by examination, the shaft should be removed and the bearing thoroughly cleaned with kerosene. If a particularly fine finish is required, the operation may be repeated, using an AF2-40 Carborundum Brand compound.

In lapping solid bearings of bronze or babbitt, a finer grade of abrasive should be used on account of the small clearances in this type of bearing (in the Carborundum Brand grading, HT2-40 or HX2-40 is recommended, the latter grade being used when a very close fit is required). The compound may be applied through oil-holes under pressure or it may be thinned with water and allowed to flow into the bushing. After applying the compound, the shaft should be turned and the same procedure followed as outlined for the lapping of split bearings. If a very fine finish is desired, the operation is repeated using AF2-40 Carborundum Brand compound. To expedite the lapping of solid bearings, it is sometimes desirable to use a split cast-iron or wood lap in place of the shaft. Water is used for thinning the compound and kerosene for cleaning the parts after lapping. On some precision machines requiring a three-point bearing, a turned wood lap flattened on three sides, on which the compound is applied, should be reciprocated straight into the bearing. This type of lap will give the three-point effect desired and create a relief space for the oil. There is no danger of the metal becoming impregnated with the abrasive grains. The characteristics of the abrasive and the carrier medium prevent this.

* * *

At the end of 1928 there were 21,380,000 passenger cars, 3,114,000 trucks, and 92,000 motor buses registered in the United States.

Notes and Comment on Engineering Topics

The budgets of the railroads in the United States and Canada call for an expenditure of $800,000,000 during 1929 for permanent improvements and equipment. This is approximately $50,000,000 more than was spent in 1928. The sum mentioned does not include the amount spent for maintenance of permanent ways, rolling stock, or shops; but maintenance expenditures are also likely to increase during the present year.

Technical schools have sometimes been criticized because their graduates know too little about the practical applications of the theoretical knowledge they possess. According to *Compressed Air*, the Missouri School of Mines and Metallurgy at Rolla, Mo., maintains a mining laboratory on the site of an old dolomite quarry, a short distance from the campus. In this way, part of the training the students receive is in close association with actual mine practice, thus establishing an ideal condition.

Careful calculations of the number of cars scrapped, obtained by considering the number of cars registered at the end of each year, the production of cars during the year, and the exports and imports, indicate, according to *Automotive Industries*, that in 1928 more than 2,500,000 cars were scrapped. In 1927, 2,367,000 cars were scrapped. These figures apply to passenger cars only. It is evident that the replacement business alone is sufficient to keep the automobile plants going at a fair rate.

Although much has been accomplished through the use of the X-ray for revealing defects in metals, results recently obtained by the application of radium rays appear to far surpass those of the former method. According to *Compressed Air*, experiments carried out by the Russian State Radium Institute, at Leningrad, have shown that radium rays will pass through pieces of metal that are too thick to be examined by the X-ray. Castings with walls 15 inches thick have been successfully examined for defects by this method. The process is also said to be inexpensive and rapid.

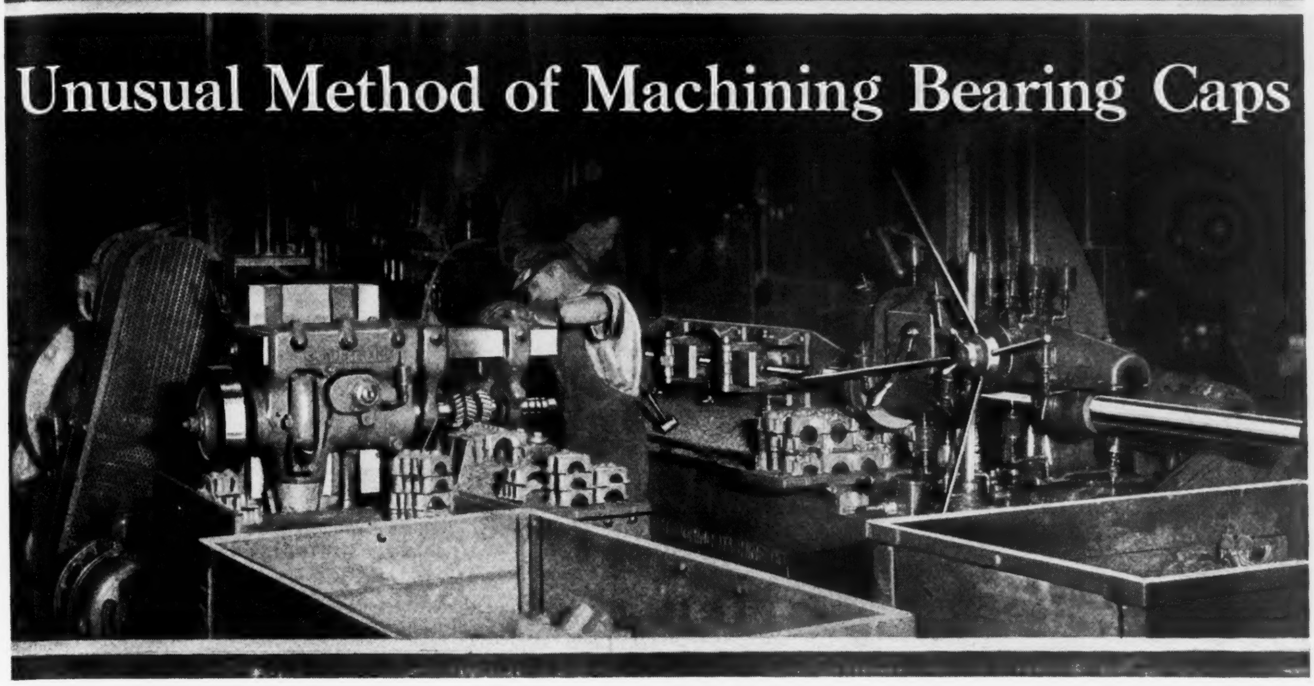
It is of interest to note how the steam turbine and the internal combustion engine are making inroads on the field of the reciprocating steam engine for ship propulsion. Both of the newer means of propulsion are making steady progress at the expense of the older type of engine. Of the large vessels launched in the world in 1928, fifteen, with a total tonnage of 138,000 tons, are provided with steam turbines, including the four largest vessels launched in Great Britain. Seventy-six ships of the ships launched during the year, with a total of 428,000 tons, are provided with internal combustion engines. This represents 42.5 per cent of the steam tonnage launched, and is a slight increase over the relative proportions in 1927.

Through the cooperation of the Simplified Practice Division of the Department of Commerce, Washington, D. C., and manufacturers of coated abrasive products, the 8000 varieties of such products kept in stock in the past will be reduced to slightly less than 2000. This is a matter of considerable importance, in view of the fact that the estimated annual output of coated abrasive products—sandpaper, emery cloth, etc., amounts to $16,000,000. Six hundred concerns engaged in the manufacture, distribution, and use of coated abrasive products have approved of the simplification program.

The *Virginia*, second electric passenger liner to be built for the Panama Pacific Line of the International Mercantile Marine Co., was given its builders' trials November 19 and was taken over by the owners November 27, when it started on its first trip for the owners—from Newport News, Va., to New York City. This liner, built by the Newport News Shipbuilding & Dry Dock Co. and completely electrified by the General Electric Co., is a sister ship to the *California*. A third vessel, practically identical with the first two, is already under construction. At the time of launching, the *California* was the largest electrically driven passenger vessel in the world, but its sister ship, the *Virginia*, is still larger, and the third vessel will be a duplicate of the second. All three ships are designed for turbine-electric drive and otherwise complete electric operation, including the operation of auxiliaries.

In comparing the industrial development of the United States with that of foreign countries, W. H. Rastall, chief of the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., points out that in the United States $23 worth of machinery was installed yearly in our industries per capita of the population. In Great Britain the corresponding figure is only $10, and in Germany less than $9, while in China it is only 5 cents. To a great extent we have here the secret of the high American wage, being, approximately, in the industrial field, three times the British wage, or four times the German wage; it also explains the extremely low state of living conditions in China. There is, however, an awakening in that part of the world. Since the Armistice, Asia, as a whole, has absorbed more than $1,000,000,000 worth of industrial machinery, and this machinery is literally working to increase the wealth and the standard of living of the Far East.

Unusual Method of Machining Bearing Caps



The Practice Followed at the Plant of the Graham-Paige Motors Corporation in Making Bearing Caps Has Effected Large Savings in Time and Costs

By CHARLES O. HERB

AUTOMOBILE engines of the six-cylinder type are now universally provided with seven main bearing caps for holding the crankshaft in corresponding bearings in the crankcase. It is the general custom of automobile manufacturers to cast these bearing caps individually and, of course, put them through the various machining operations singly. This means the handling and clamping of seven separate pieces in each operation.

At the plant of the Graham-Paige Motors Corporation, Detroit, Mich., the idea was conceived that substantial savings would be attained in work-handling time and in jig, fixture, tool, and labor costs, if several of the main bearing caps could be made as one casting and run through most of the operations in that way, afterward being sawed apart into separate caps. It was also realized that material costs would be considerably less if this practice were followed. The idea has been put into effect with unusually successful results. With only five men, from 225 to 230 complete sets of caps are finished per nine-hour day. Each man tends to at least two machines. Important operations in this main-bearing cap department will be described in the present article.

In Fig. 1 it will be seen that the four intermediate bearing caps are cast in one piece *C*, and the front and middle main bearing caps in a second piece *D*. The rear bearing cap *B* makes a third casting. With this method, only three castings are handled in all operations up to the final one, in which the combined castings are sawed apart. The seven finished bearing caps are shown at *A*.

Milling Operation Speeded Up

The first operation consists of simultaneously milling the bolt-hole and oil-plug bosses of castings *C* and *D*—seventeen bosses in all—in a Sundstrand "Rigidmil" milling machine equipped as illustrated in Fig. 2. As one oil-plug boss on casting *D* is lower than the other, it is left unfinished in this operation.

Simplicity of design is a feature of the fixture used on this machine. Each casting is seated on three plugs which insure that it is located at the proper height. Sidewise location of the castings is obtained by clamping V-blocks *E* between the bolt-hole bosses, thus forcing the work against hardened steel blocks at the back. The clamping is accomplished by swiveling eccentric clamp plates *F* against blocks *E* and then applying a wrench to the heads of the bolts that secure the clamps to the fixture base. Provision is made for adjusting the hardened steel plates at the back of the fixture to compensate for wear.

Rough-boring the Caps

The second operation on the three main bearing cap castings consists of rough-boring them. This is done at this point so as to remove the major portion of the excess stock near the beginning of the operations and thus avoid springing of the castings after other accurate surfaces have been machined. The boring is done in a Universal boring machine equipped with the fixtures and tools illustrated in Fig. 3. The first fixture from the right is designed to receive the rear bearing cap *B;* the second fixture, the combined front and middle bearing cap *D;* and the third fixture, casting *C*, which comprises the four intermediate bearing caps.

These fixtures are of unusually simple design. Each casting is clamped against four horizontal plugs at the back by merely operating handle *E*. On the shaft to which each of these handles is at-

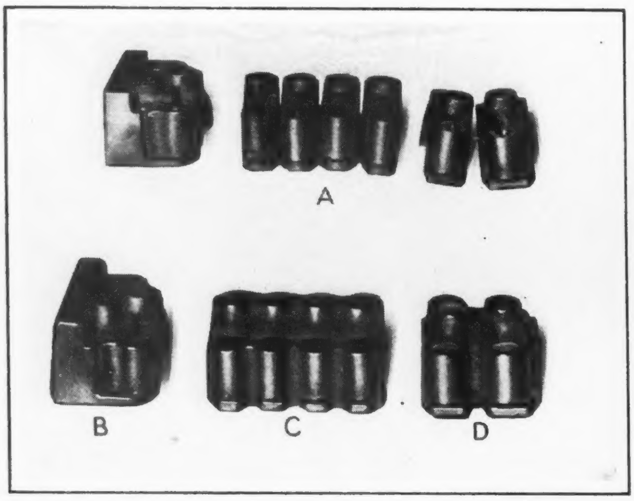


Fig. 1. Seven Crankshaft Bearing Caps and the Three Castings from which They are Produced

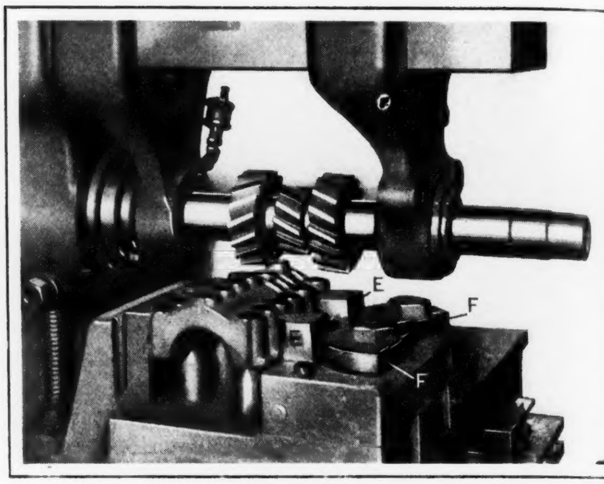


Fig. 2. Milling the Bolt-hole and Oil-plug Pads of Castings C and D, Fig. 1

tached, there is a cam *F* which bears against plate *G* to which two plugs are attached. Thus when the handle is operated, plate *G* forces the two plugs firmly against the front of the casting. Clamp *H* is tightened to force the top of the work against two adjustable screw-stops, which are positioned to centralize the castings with boring-bar *J*.

The boring-bar is provided with four cutters, two of which rough-bore castings *C* and *D*. The other two cutters operate on the rear bearing cap *B*, one of them rough-boring the bearing portion, while the other finishes the narrow rim of metal in front of the oil thrower groove. Boring-bar *J* has a movement only slightly greater than the length of casting *C*.

In this operation, the actual machining time for the three castings is one minute, and the reloading time 30 seconds. If seven castings had to be clamped, as would be the case if the bearing caps were cast individually, the reloading time would obviously be much greater.

Rotary Continuous Milling Operation on the Caps

Milling of all three castings on the joint surfaces where the caps are bolted against the crankcase is performed on a Davis & Thompson continuous milling machine equipped with roughing and finishing face milling cutters of the inserted-blade type, which are about 9 inches in diameter. The rear main bearing cap *B*, Fig. 1, is carried past the cutters twice, once for milling the joint surfaces, as mentioned, and a second time for milling the opposite side.

Eight work-holding fixtures—two complete sets—are mounted on the faceplate in the manner illustrated in Fig. 4. The faceplate simply revolves to carry the castings across the milling cutters, there being no longitudinal movement of either the work or the cutters. The milling machine stops automatically after each group of four pieces has been traversed across the cutters.

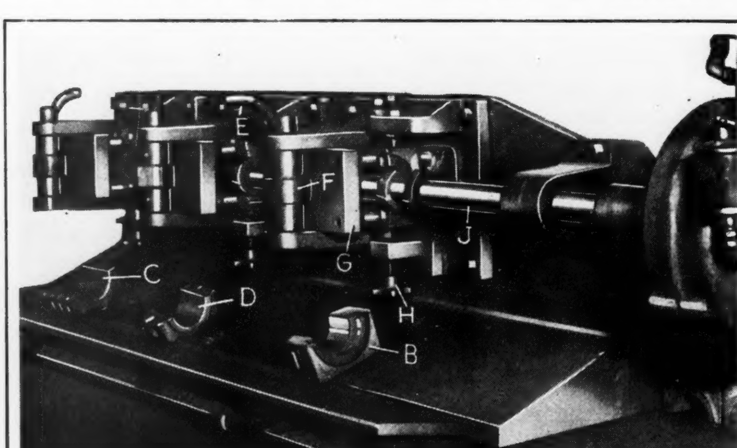


Fig. 3. Simultaneously Rough-boring the Three Castings that Comprise a Complete Set of Crankshaft Bearing Caps

Clamping means of unusually simple design are employed to hold the castings in the fixtures. Castings *C* and *D* are seated on the finished bolt-hole pads and held in place by hinged clamps *E*, which fit the rough-bored bearing surfaces. The rear main bearing cap casting *B* is seated on an unfinished surface for the first movement past the cutters, and is also held by a hinged clamp *E* which comes in contact with its rough-bored bearing surface. During the second traverse past the cutters, this casting is seated on the surfaces finished in the first pass. Hinged clamps *E* are held firmly against the work by swiveling clamp bolts *F* over the slotted ends of the arbors. These clamps extend through the faceplate and are held by nuts on the front side.

Drilling Seventeen Bearing Caps at One Time

At the end of the milling operation just described, the castings are transferred to a multiple-spindle drilling machine, where the bolt holes are completely drilled through and the oil-plug holes drilled part way through. The oil-plug holes must be drilled in two separate operations, since they are of two different diameters. Drilling of the bolt holes and oil-plug holes is accomplished with the castings seated on their finished bolt-hole pads and with the bearing surfaces extending upward. Plugs that fit the rough-bored bearing surfaces locate the castings accurately. Each part is gripped

by the jig bushing plate as the latter descends.

Fig. 5 illustrates another drilling operation, in which two of the intermediate bearing caps C, Fig. 1, two castings D, and five rear cap castings B are drilled simultaneously. These castings, after being completely machined, give a total of seventeen caps. Eighteen drills and one reamer are employed in the operation. The various parts are located by seating their bolt holes over dowel-pins on the jig, with the exception of two of the rear bearing caps. In these two positions, the rear bearing caps are located between short plugs which fit their rough-bored bearing surfaces and two pins which come in contact with their opposite sides.

This operation consists of drilling all oil-plug holes; all bronze bearing dowel-pin holes; and the oil flange feed hole; as well as drilling and reaming one blind hole in the rear bearing cap. At each downward movement of the overhead jig bushing plate, a complete set of three castings is finished, and between these movements the castings are moved into the different positions. The rear bearing cap is placed in five different positions before it is completed, while the other two castings are placed in two positions each. The jig bushing plate is of a full floating design, and seats accurately over pilot pins when it descends.

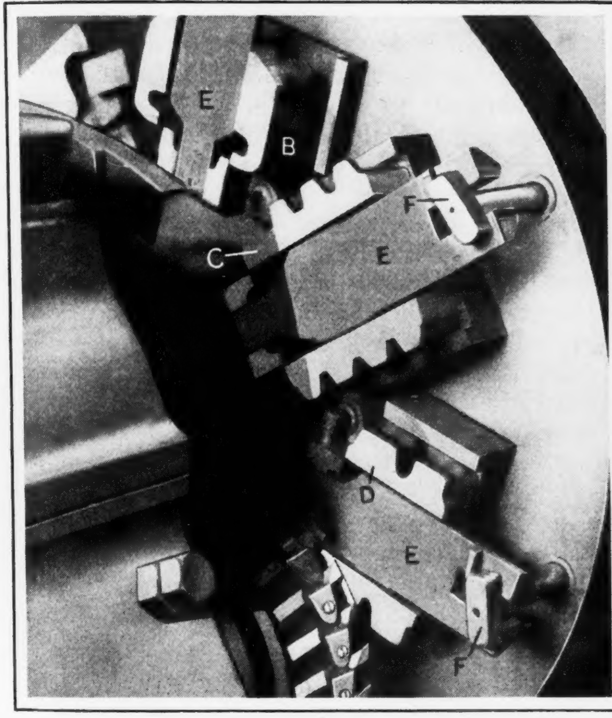


Fig. 4. Rough and Finish Face-milling Operation Performed on all Three Cap Castings

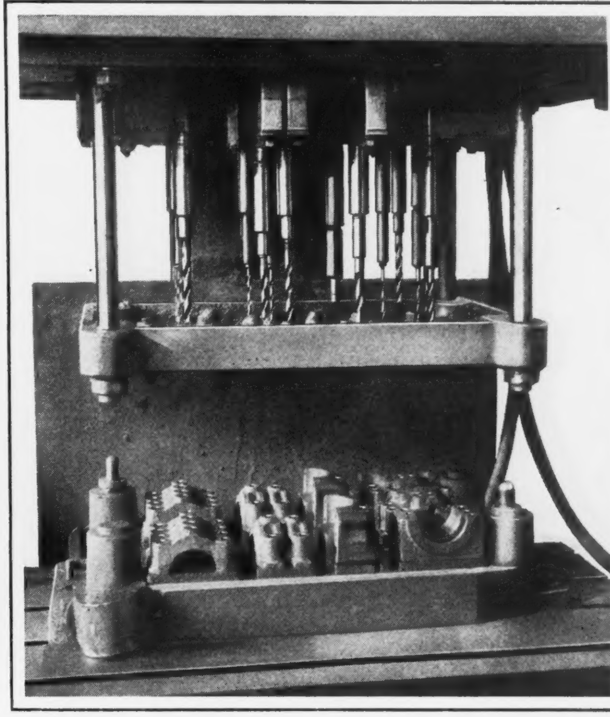


Fig. 5. Operation in which Eighteen Drills and One Reamer Simultaneously Operate on Nine Castings

When the bearing cap castings are taken from this multiple-spindle drilling machine, they are placed—a complete set of three castings at one time— on a second "Rigidmil" for milling the cap ends. This dimension is held within plus or minus 0.001 inch. Two bolt holes in each casting are seated over dowel-pins and positively located from the center of the bore. Quick-operating clamps hold the castings in place.

Miscellaneous operations, such as reaming, boring, tapping, and spot-facing are next performed on individual machines. These operations are also considerably accelerated by the fact that there are only three castings to handle for each set of bearing caps, instead of seven.

Cutting the Castings into Individual Caps

The intermediate cap casting C, Fig. 1, and the combined front and middle cap casting D, are simultaneously split into six caps in the milling machine illustrated in Fig. 6. Two work-holding fixtures are mounted on the table, one on each side of the cutter-arbor, so that a set of bearing caps can be loaded into one fixture while the caps in the other are being split.

Previously finished edges of both castings are seated on a hardened block which extends the length of each fixture. The castings are gripped between a series of fixed blocks A at the front, and movable plugs B at the back. There are two blocks A, which have twelve locating pins, and two plugs B for each cap, so that the individual caps are held securely after being split from the casting.

The twelve plugs B of each fixture are moved in unison by operating handle C. This handle actuates a cam which, in turn, moves a plate to which the twelve plugs are fastened. Eight cutters are mounted on the arbor—four face milling cutters which finish the outer side of the end caps, and four slitting saws which produce the individual caps and at the same time mill them to width. The cutters for casting C, Fig. 1, are 6 inches in diameter, and those for casting D, 4 inches in diameter. The slitting cutters are 3/16 inch thick.

Final Operations

The front and rear faces of the rear main bearing cap B, Fig. 1, as well as the oil retainer recesses, are milled to size in a third "Rigidmil" milling machine, which comprises a part of the bearing cap machine line-up. Both faces of the front bearing

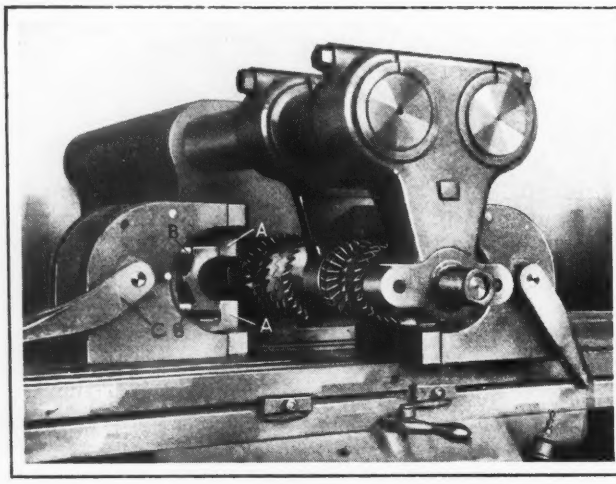


Fig. 6. Slitting Two Castings into Six Bearing Caps, and at the Same Time Face-milling the End Caps

cap are also milled to width in this machine. The width of the two caps must be held to size within plus or minus 0.015 inch. Before delivery to the assembly lines, the bearing caps are cleansed from all dirt and chips in a washing machine.

* * *

BEARINGS OF HIGH-LEAD BRONZE

By DONALD A. HAMPSON

The so-called high-lead "bronzes" seem to be gaining in favor. MACHINERY'S HANDBOOK lists "P.R.R. car brass B" (76 copper, 15 lead, 8 tin) as one of the best bearing bronzes. This material was an early development of Dr. Dudley's work in making copper carry lead, and it represents the low-lead limit of present-day "high-lead" bronzes, the other extreme being a 50-50 copper-lead mixture.

Phosphor-bronze can never be superseded by the high leads, because the latter will not carry as great loads. But for special applications such as light, high-speed work on machinery and pulleys, for places where lubrication is likely to be infrequent and where scoring of the shaft is a serious matter, high-lead bronzes are very satisfactory.

This material may be obtained in solid and cored bars from stock, and is also made from patterns molded in green sand. It works easily and takes on a desirable glaze after short service. With the higher lead contents, it is necessary to ream or bore the holes after the bearing has been pressed in place, owing to compression of the metal. Roughly, the clearance allowance made when boring should be 50 per cent more than for the usual materials.

The high lead content makes these metals excellent in lubricating qualities, and their non-scoring feature cuts replacement costs in two. Temperatures up to 600 degrees do not affect these qualities.

* * *

SAFETY DEVICE FOR FOOT PRESSES

By NICHOLAS HEYMAN

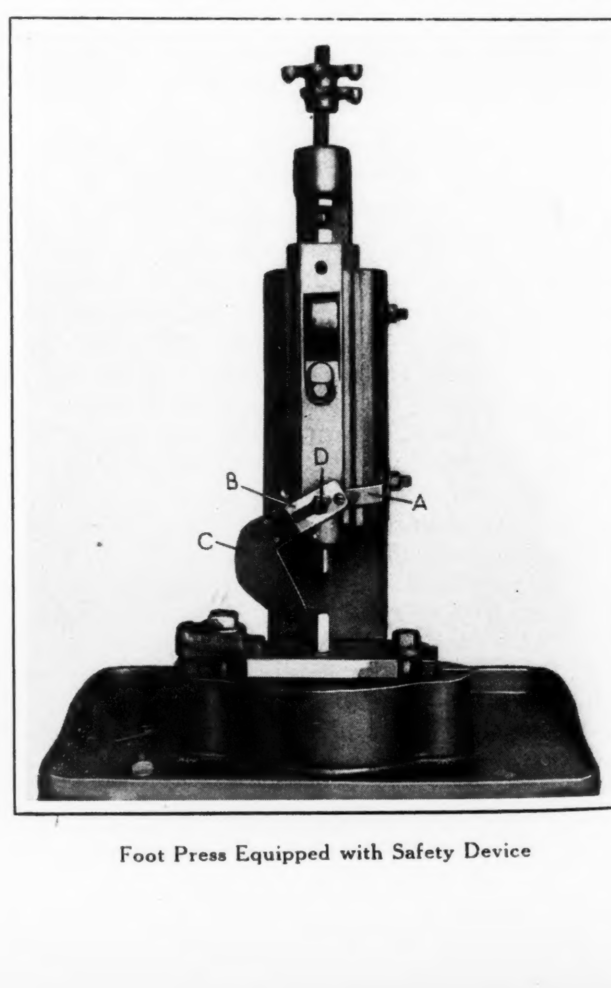
For years our plant had given little or no attention to the application of safety devices to presses of the foot-operated type. In the majority of plants these machines are not considered dangerous. It is commonly believed that since the action of such presses is controlled entirely by the operator's foot, accidents are more or less avoidable. On analyzing our accident report at the end of the year, however, it was found that 70 per cent of the accidents were caused by this type of press, while the remainder were caused by power presses and miscellaneous equipment.

Although it is true that one power press accident may cost more in liability than all the foot press accidents combined, still, in quantity, the latter source predominated. It was therefore decided to develop a simple device to relieve this condition. This device, as it appears when attached to the foot press, is shown in the accompanying illustration.

The safety device consists essentially of the bracket *A*, arm *B*, flag *C* and the mounting screw *D*. The guard is of the sweep type, that is, it sweeps across the danger zone in advance of the descending ram. The shoulder of the screw *D*, traveling in the slot of arm *B*, imparts the sweeping motion to flag *C*, which serves to push the fingers of the operator away from the descending punch. It is a simple matter to attach the guard, as no holes are required other than those already on the machine.

To attach the device, simply place the bracket *A* under the gib screw as shown, remove the screw that holds the punch-holder in the ram, and replace it with the special shouldered stud supplied with the device. The bracket and arm may be made of steel, iron, or malleable cast iron. The flag may be of light gage metal and have a rubber tip at its nose to protect the operator's hand.

In all, eighty presses were equipped with the safety device described, and as a result, accidents on foot presses have been practically eliminated. The guards have also proved a good investment from the production point of view, as the operators can work at higher speed without fear of injury.



Foot Press Equipped with Safety Device

What MACHINERY'S Readers Think

Brief Contributions of General Interest in the Mechanical Field

CHANGES IN ENGINEERING STANDARDS

Engineering standards are sometimes changed because of improvements or developments not known or ascertainable when the standard was originally adopted. Such changes are justified because they make the standard conform to modern conditions or developments. But too frequently standards are changed merely because they were inadequate when introduced, and the need for changes soon becomes apparent when the standard is tested by practical application. In such instances, it is evident that the changes do not indicate progressiveness, but incomplete work in the beginning. Many of the most useful and valuable standards remain unchanged over a long period of years, and continue to meet practical requirements because their originators did a good job and perfected the standards as far as possible before their adoption.

In view of the frequent changes made in standards, it would seem at times as though the basic idea of standardization is overlooked. Since a standard represents a definite series of dimensions or other elements selected for general use in an industry, to obtain interchangeability or to avoid needless variation and waste, it is apparent that the problem of standardization involves determining at the outset, as far as is humanly possible, what dimensions or elements appear to be the most practicable and *stable*, so that all *unnecessary* future changes can be avoided.

The revisions that have been required in many recent standards indicate initial defects which could have been avoided by more thorough preliminary work. The value of any standard depends upon the *extent of its industrial application*, and application requires a reasonable degree of *permanence*.

When new standards are regarded as "tentative" and changes are frequently made, the inevitable result is confusion and a lot of conflicting data in hundreds of thousands of engineering handbooks and text-books, as well as on drawings and other records. It is a relatively simple matter to change a standard in so far as official recognition of an organization is concerned, but the vast number of books and other records containing the obsolete standard cannot be recalled and revised; and it is an important fact that the engineering handbook is the chief means for placing standards in the hands of those who actually use them.

Quantity should be sacrificed to quality in all standardization work. JOHN BRADFORD

ARE THERE TOO MANY CONVENTIONS?

Unless there are more conventions being held than I have any record of, I would unhesitatingly say that there are not too many; but from personal experience in attending conventions, I believe there is altogether too much time wasted by lateness in starting sessions, duplication of discussion, irregular attendance of those delegated to be there, and undue haste in closing just about regular meal hours.

Most of those who attend technical conventions are employed in some supervisory capacity at home. They are always on the job, starting promptly in the morning and are, perhaps, the last to leave at night—men who would consider it impossible to have their own shops or departments run in the easy-going, slipshod, and inefficient manner in which many conventions are conducted.

No, there are not too many conventions, but let us have them conducted as we conduct our own shops, and work at least as long hours as we do when on our regular jobs. Let us treat attendance at the convention as seriously as we do our regular work. Conventions are not vacations, and should not be treated as such. Entertainment provided by supply dealers' representatives, except perhaps in the evening, ought to be eliminated. The results obtained from the meetings would be very much greater if that were the case.

GENERAL CHAIRMAN

ADVANTAGES OF PAYROLL CHECKS

The experience of a group of ten machinery and tool manufacturers who for varying periods have been paying their employes by check instead of by cash is of particular interest at this time, due to the steadily increasing activities of payroll bandits, and the recent steps taken by the National Crime Commission looking toward the development of a payroll system that will be proof against this type of crime.

Each of the manufacturers gives as one of the principal advantages of the change from a cash to a check basis the elimination of the danger of hold-ups, either during the transportation of the payroll money through the streets or during its distribution in the plant. Other advantages of the check system, as cited by one or more of the manufacturers, are as follows: (1) Checks furnish a receipt and permanent record of payment, thereby eliminating arguments between the paymaster and employes. (2) Checks require less clerical work and are more economical of both time and labor. (3) Checks promote thrift by leading employes to open savings accounts. (4) Checks protect the employe from loss of his wages through theft or carelessness, since a duplicate check can usually be issued to cover the loss.

The possibility of an unfavorable reaction from employes causes many employers to hesitate to adopt check payments, although they may be thoroughly convinced of the desirability of the change.

While lack of familiarity with checks and banking practices may lead the employes to view the new system with suspicion at the start, the evidence goes to show that this attitude can be readily overcome in the majority of instances.

Eight manufacturers state that their employes have made no objection to the installation of the pay-by-check system. One states that there have been no objections to speak of. Another says that the men had objected to being paid off on Saturday, as they lost part of the half holiday cashing their checks. Pay day was changed to Friday noon, to allow the men to cash their checks during the noon hour.

So far as cashing the checks is concerned, there is usually no difficulty when the banks and merchants have once become accustomed to the system. Many banks and their branches now remain open one or more nights a week to permit employes to cash their checks. Aside from any question of service to their depositors, the majority of the banks find that it is to their financial advantage to lend every aid and encouragement to the use of checks for payrolls.

The practicability, safety, and ease of operation of the pay-by-check system have been increased in recent years by the development of mechanical devices for writing and signing checks. Check-signing machines now on the market are capable of signing 7500 checks an hour. W. H. P.

MANUFACTURING FROM SAMPLES

Commenting upon the article "Manufacturing from Samples," which appeared on page 348 of January MACHINERY, the writer would like to point out a few difficulties encountered in the drafting-room when detailing from samples. One important point is in applying suitable tolerances, which, if noted at all on the drawing, are generally based on guesswork. If the draftsman is over-cautious in choosing the tolerances, the manufacturing cost may be high. Again, the exact material, hardness, etc., of the sample may be rather vague in his mind. Unless the manufacturer is willing to take long chances, it may be a costly procedure to go into production guided by a drawing made from an unverified sample. FRANK KAHN

It has been my experience that the cost of making sheet-metal parts is generally less when samples are used as guides than when the parts are made according to blueprints or sketches. In this respect, I do not fully agree with the article on page 348 of January MACHINERY. Most sheet metal manufacturers and workers prefer to see and examine a sample of any article to be manufactured, but unfortunately samples are not always available.

When a sample is supplied, the mechanic quickly discerns how the article is constructed, the type of joints required, the kind of materials used, and the style of finish desired. On the other hand, when he must work to blueprints, he often finds it necessary to spend considerable time studying the blueprints before he is able to understand clearly just what is required. There are few mechanics in the average shop who can grasp quickly and accurately the requirements indicated on conventional blueprints, especially when the part is somewhat complicated.

Then, again, if proper dimensions and adequate details are lacking on the blueprint, as occasionally happens, much is left to guesswork. Another disadvantage of blueprints is that they frequently become soiled and illegible, whereas a sample can generally be depended upon to maintain its shape and size. Altogether, the writer's experience shows that the use of samples instead of blueprints is a good practice, and one that pays in jobbing shops handling sheet-metal work. A. EYLES

FREE ENGINEERING ADVICE

Commenting upon the different expressions of opinion that have appeared in MACHINERY on free engineering service rendered by machine and tool manufacturers, I would like to mention that one well-known concern in the metal-cutting tool field, which has made it a business to study the customer's needs and to recommend to him means for successfully accomplishing a required result, has inaugurated a plan whereby an engineering study to improve production will be charged for as consulting engineering service, aside from the tools that may be ordered from the company later. This company is soliciting business on the basis that it can increase production at a reduced cost for tools, because of its knowledge of metal-cutting problems.

There is no reason why consulting engineering service should not be paid for as such, whether it is rendered by a manufacturer of tools and equipment, or by a consulting engineer whose only business is that of studying an engineering problem and furnishing recommendations. OBSERVER

HOW WORKMEN HELP MAKE ESTIMATES

When much of the work of a company is on special orders and it is difficult to estimate the time required for any one job, it is best to have the assistance of the workman in setting cost estimates. With the average inquiry, the necessary drawings and specifications and a request for an estimate are sent. The superintendent works out, from the drawings, an estimate of the time required for the various operations and sends for the foreman. The entire job is discussed, and the foreman is asked to give his opinion. Often the superintendent and the foreman find points on which they differ.

If they cannot agree as to the time that will be required for any operation, the question is put directly to the workman. He is shown the drawing, told about the job, and asked, for instance, if he cares to take it at seven hours. If he does not, he gives his reasons for thinking it will take longer. If he does take it and reduces the time below the estimate, it is his gain, as he will be paid a bonus for the estimated time gained. Good results have been obtained by enlisting the cooperation of the men in this way. It may be surprising, but there are few cases where the agreed time is exceeded, when this procedure is followed.

ARTHUR FRUNCILLE

Hardening and Tempering Wrench Parts

Gas-fired Lead Pot Hardening Furnaces and Oil Tempering Tanks have Given Excellent Results in the Heat-treatment of Wrench Parts

By J. E. HART, General Superintendent, Boston Works, Walworth Co.

THE bars and jaws of the Stillson wrenches manufactured by the Walworth Co. are drop-forged from basic open-hearth steel having a carbon content of approximately 0.80 per cent. After the forging and trimming operations, these parts are put through an annealing process to make them readily machineable. Upon the completion of the machining operations, the parts are heat-treated for toughness. After that, they are hardened and tempered around the tooth sections.

The carriages are pushed to the lead pots and the loaded fixtures are immersed in the molten lead for a definite length of time. Temperature control devices which operate automatically govern the temperature of the lead pots, and a signaling device controls the element of time. The operator is notified by the ringing of a bell and the flashing of a light when a fixture has been in the lead pot for the proper length of time.

When the fixtures are withdrawn from the lead bath, they are transported along the track to a tank filled with water. Here the parts, still in the fixtures, are rapidly quenched, withdrawn, and conveyed by means of the carriage to the unloading station. A temperature control is also provided for the quenching bath. The unloaded fixture is switched to the track that runs at the rear of the quenching tank and furnaces and returned to the loading station, thus completing the cycle.

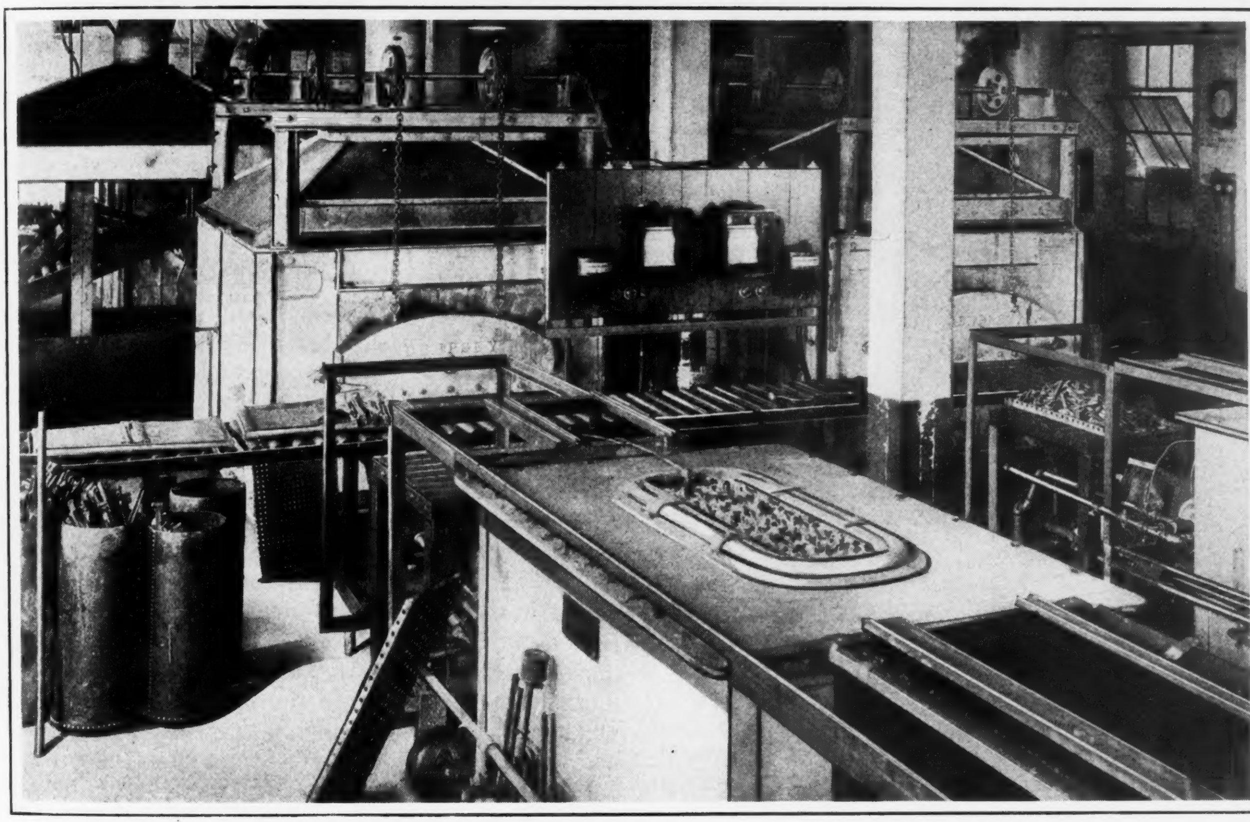


Fig. 1. Lead-pot Furnace in which Walworth Stillson Wrench Parts are Immersed for Hardening

Modern gas-fired equipment recently installed at the Boston Works of the company permits the hardening and tempering operations to be performed on a quantity production basis. The procedure followed at this plant in hardening and tempering wrench parts is described in the following.

Lead-pot Hardening Furnaces Used

Two large lead-pot furnaces of the type shown in the foreground in Fig. 1 are employed to heat the wrench parts for hardening. The parts are first loaded on fixtures, which are placed on carriages having roller bearing wheels. Each fixture contains a definite load. The carriages run on tracks erected over the furnaces and the quenching tank of each installation; in the illustration, the sections of these tracks over the furnace are not shown, having been removed when the picture was taken.

The gas consumption of each furnace per week does not exceed 35,000 cubic feet of 530 British-thermal-unit gas, when the temperature is maintained at 1450 degrees F.; when the production is at a constant rate of 15 pounds of work every 2 1/2 minutes; when the surface of the lead in the pot is kept covered with at least a 1 1/2-inch layer of charcoal; when the work is heated at the rate specified for nine hours during each ordinary week day

and five hours on Saturdays; and when the pot is covered at night with 6 inches of insulation.

After the work has reached the temperature of the lead bath, the temperature variation in a horizontal plane 6 inches below the surface of the lead does not exceed plus or minus 10 degrees F., provided the pot is full to within 2 inches of the top. The temperature of the lead bath does not rise more than 20 degrees F. above the normal operating temperature after the work reaches the bath temperature.

Advantages Over the Previous Installation

In the original installation, the furnaces were relatively small, with a correspondingly small lead capacity, and the charges were proportionately large, so that the entrance of a cold charge caused a considerable drop in the temperature of the bath. To compensate for this, it was necessary to use both a longer heating cycle and a higher temperature in the combustion chamber, which resulted in considerable grain growth in the metal of the parts, due to the length of time they were under heat. Also the bath had a decided tendency to "coast" beyond the desired temperature after the work had reached it.

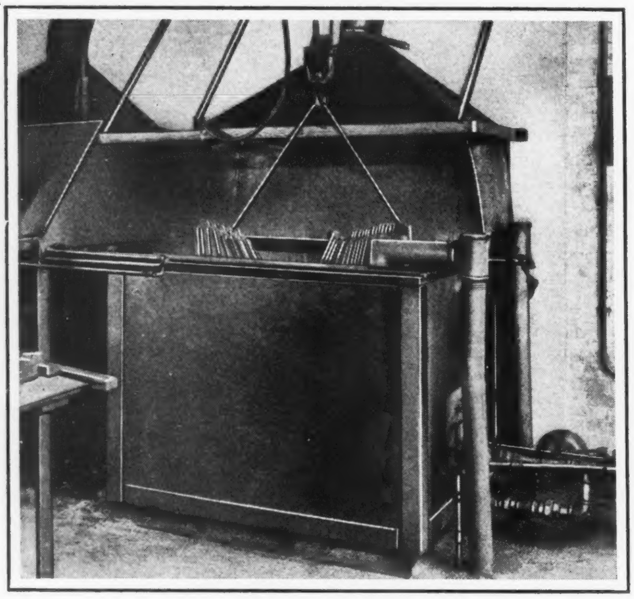


Fig. 2. Gas-fired Oil-tempering Tank in which the Combustion Chamber is Submerged in Oil

With these points in mind, the new furnaces were designed to receive a large volume of lead in proportion to the anticipated weight per charge, with a consequent large heat storage capacity which permits the immersion of a cold charge with a drop in temperature of only between 15 and 20 degrees. The firebrick walls of the combustion chambers were made only 2 1/2 inches thick, in order to decrease, as much as possible, the heat storage capacity in the brick and thus hold the "coast" to a minimum. To further limit the "coast," a dual temperature control having one thermo-couple in the lead bath and another in the combustion chamber, was installed. In this way, the temperature of the combustion chamber lining is always held below a point where the heat stored in the walls will have any appreciable effect on the temperature of the lead.

The Parts are Tempered in Oil

Strains set up in the steel parts from the rapid water quenching are relieved by the tempering operation almost immediately after quenching. For the tempering process, the parts are placed in baskets, and by the use of a hoist on an overhead monorail, the baskets are conveyed to an oil-tempering tank and lowered into it. This tempering is conducted at a specified temperature, which produces a tooth section on one wrench part not so hard that the teeth will chip nor yet so soft that they will become blunt. The work is kept in the oil bath for a definite period of time to insure the desired tempering, a signaling device being provided to indicate when this point has been reached. The temperature of the oil bath is also automatically controlled. At the end of this heat-treatment, the hardness of the parts ranges from 54 to 58 on the C scale of a Rockwell hardness tester.

The tempering tank is also gas-fired. A group of tile gas burners are enclosed in a small air-tight combustion chamber, which is built into the side of the tank close to the bottom, so the combustion chamber is practically submerged in the oil. The refractory of the combustion chamber transfers the heat to the oil.

* * *

WORLD'S LARGEST WELDING LABORATORY

The Westinghouse Electric & Mfg. Co. has just completed, at the East Pittsburgh Works of the company, what is said to be the largest arc-welding laboratory in the world. This laboratory is 170 feet long, 75 feet wide, and 40 feet high, and contains the latest developments in arc-welding apparatus. The equipment includes a 15-ton crane and massive rolling and forming equipment to be used in forming and shaping the various parts that, when welded together, will form turbine generator frames, locomotive frames, synchronous motor frames and spiders, boxes, machinery bases, floor plates, tanks, and miscellaneous machinery parts.

The progress made in the past years in the arc-welding of various types of buildings and bridges has received so much attention that only a few people, even among those working in manufacturing plants, have become aware of the development of welding in the manufacture of machinery of all kinds. Large generators, motors, and other apparatus, which for years have been constructed of immense castings, are now being formed of pieces of standard structural steel, welded together. A 26-ton turbine generator frame, entirely welded, has been fabricated in the Westinghouse laboratory.

* * *

According to the National Industrial Conference Board, New York City, employment in the manufacturing industries in the United States at the beginning of the present year was on the average, higher than at any time since the second quarter of 1926. The purchasing power of the average weekly earnings per worker in the industries at the beginning of the year was nearly 6 per cent greater than at the beginning of 1927. The purchasing power of the weekly earnings of industrial workers averaged 38 per cent higher than in 1914.

Letters on Practical Subjects

DEVICE FOR CHECKING PRECISION MITER GEARS

The slightest variation in timing between the voice and the movement of the lips in a talking-moving picture, is quickly detected by the eye. Hence, the development of synchronizing mechanisms for obtaining the extremely close coordination of the voice and the picture calls for precision of the highest degree. Compensating devices are used which enable the operator of a machine to quickly correct any error that develops while the picture is being shown, but to avoid constant attention on the attendant's part, the device must be accurately made. The precision miter gear assembly in Fig. 1 is an important element of a device of this kind.

In Fig. 2 is shown a gage employed to check the precision of the miter gears. The four miter gears *A* shown in the assembly in Fig. 1 must function without the slightest lost motion while revolving on a solid four-pin spider *B*. To prevent excessive wear on the contact point of the gear teeth, due to the inward thrust, each gear is provided with a small ball bearing *C*, located between the face of the spider hub and the recess in the gear.

Naturally it is a difficult matter to make duplicate miter gears of the required accuracy. The ball bearings employed are of the highest known quality, and the gears are cut on the finest machines made. In order to maintain exact interchangeability, it is necessary that the depth of the recess

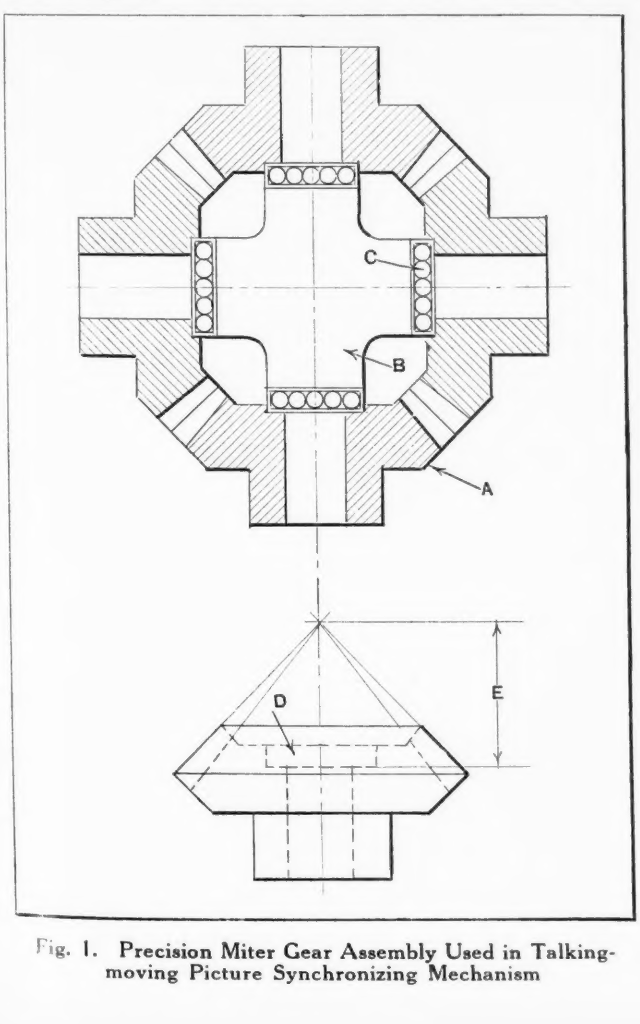


Fig. 1. Precision Miter Gear Assembly Used in Talking-moving Picture Synchronizing Mechanism

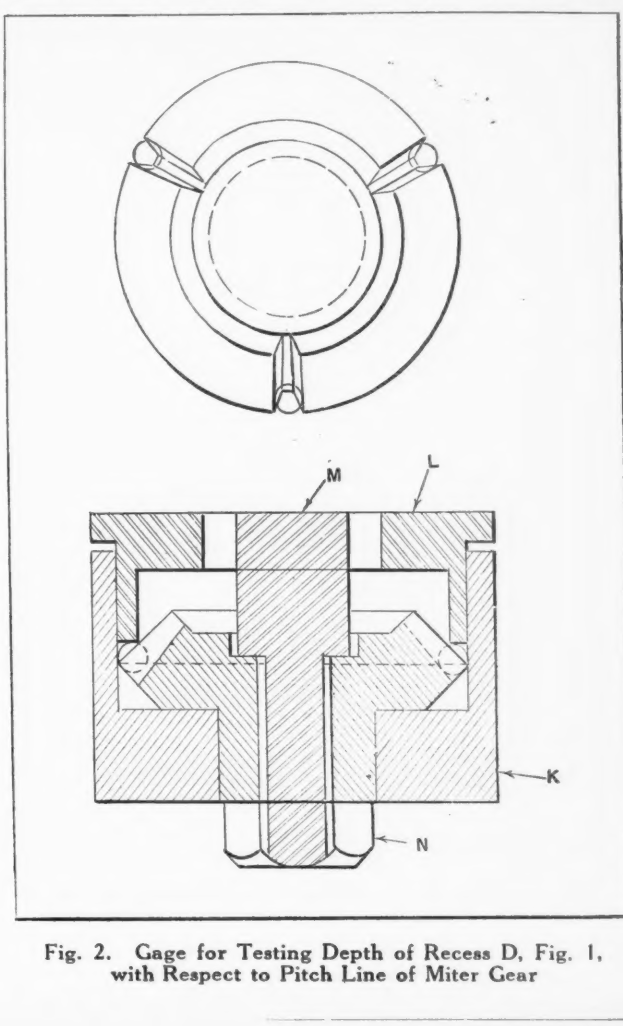


Fig. 2. Gage for Testing Depth of Recess D, Fig. 1, with Respect to Pitch Line of Miter Gear

D be extremely accurate with respect to the pitch line or contact points of the gear teeth, as indicated by the dimension E in the lower view of Fig. 1. The unique gage shown in Fig. 2, for checking the accuracy of the dimension E, Fig. 1, has proved highly satisfactory for regular inspection service.

The cup K was made to take the gears after machining, the outside diameter of the gears fitting the inside diameter of the cup very accurately. With the gears in place in the cup, three small steel balls of a suitable size were dropped into three tooth spaces of the gear, as shown in the upper view, in which only three teeth are shown for the sake of simplicity. These steel balls, which did not need to be equally spaced, were of such size that they made contact with the teeth on the pitch line, as nearly as possible.

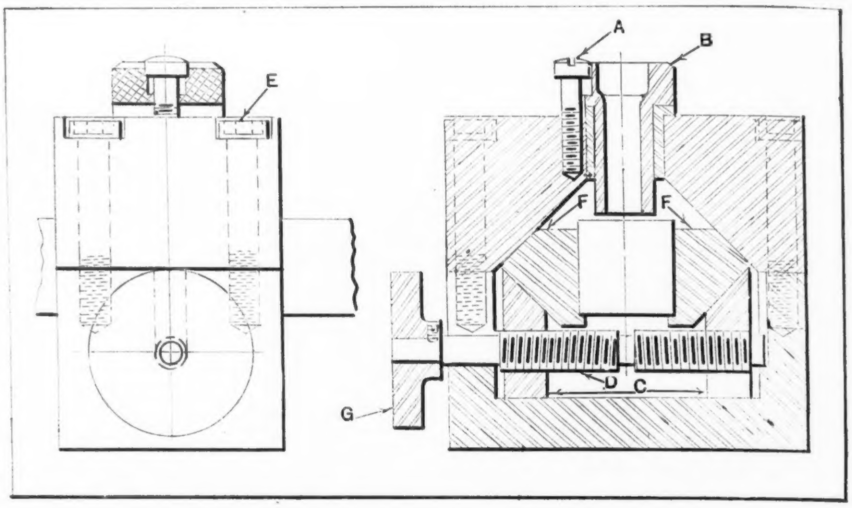
The steel part L, made of tool steel and hardened and ground, was then inserted in part K so that its inner end rested on the three balls which protruded slightly above the tops of the gear teeth. A plug M, also of hardened tool steel, was then clamped in the bore of the gear with a nut N as shown. The top of plug M and the part L were then ground to exactly the same height.

After one set of gears was machined correctly and the gage member ground as described, it was only necessary to locate each gear in the gage as shown, with the three balls and members M and L in place, and then pass an indicator over the tops of M and L in order to detect any error in dimension E, Fig. 1.

Baltimore, Md. R. H. DAUTERICH

JIG FOR DRILLING HOLES IN CENTER OF SQUARE STOCK

A jig that saves considerable time in drilling holes in the center of either square or rectangular stock is shown in the accompanying illustration. This jig is especially useful in a job shop, as it will accommodate a wide range of sizes. In the case of the particular jig shown, any desired size of hole up to 5/8 inch in diameter may be drilled by using a bushing B of the required size.



Centralizing Drill Jig for Square or Rectangular Stock

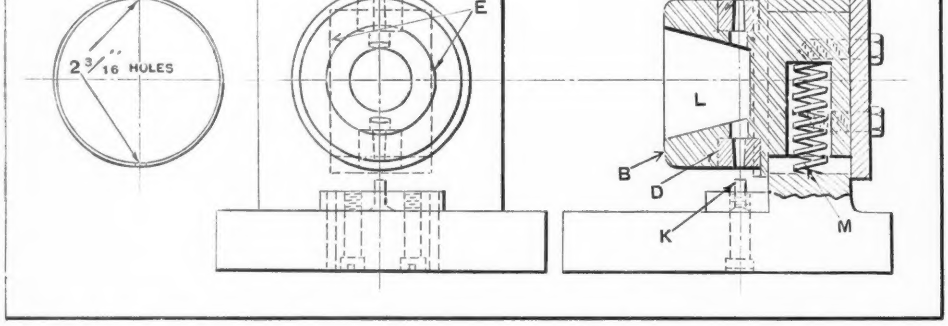
In changing from one size of drill bushing to another, it is necessary to remove cap-screw A. This cap-screw prevents the drill bushing B from turning with the drill and also prevents it from being withdrawn when the drill is raised. The drill bushing is so made that it can be readily moved up or down to suit the size of stock being drilled.

The jaws F which grip the work are actuated by the wedge-blocks C. These blocks are threaded to fit the screw D, which has right- and left-hand threads. When screw D is turned to the right by means of the handwheel G, the two jaws F move inward simultaneously and thus center the work under the bushing B.

Waukegan, Ill. W. L. ROMICK

PIERCING DRAWN SHELLS ACCURATELY

When accuracy is essential in piercing holes directly opposite each other or on the same vertical center line in drawn shells, the inexpensive die shown in the accompanying illustration will give excellent results in material up to 1/16 inch thick.



Die for Piercing Two Holes in a Drawn Shell, as Shown at Left

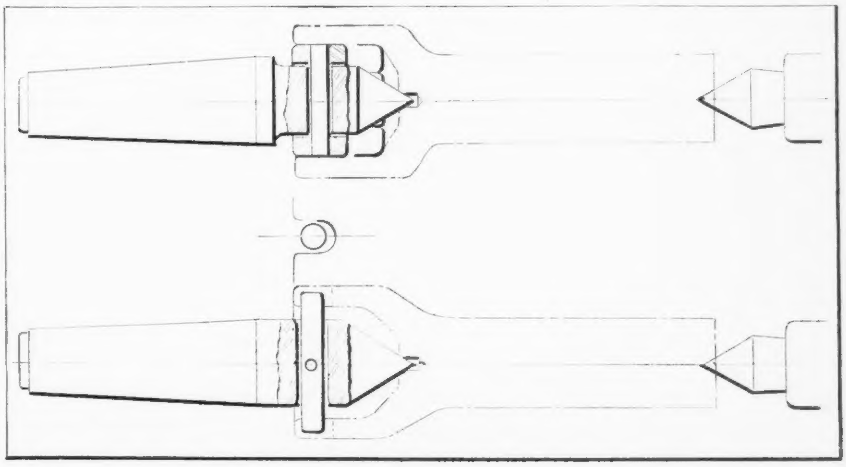
Several dies of this type are in constant operation in the plant of the Schwarze Electric Co. at Adrian, Mich. As the holes are put in with one stroke, these dies have been found not only economical in production costs, but the holes are consistently within the specified limits of plus or minus 0.001 inch.

To insure this accuracy, great care must be taken in constructing the die. Die-block B should be fully machined to size and fastened to the faceplate on the dividing head of the milling

machine. With a center indicator in the spindle of the machine, *B* can be readily trued into position to spot, drill, and bore bushing hole *C*. Before spotting, however, and with the milling machine securely locked laterally, the indexing crank of the dividing head should be turned so that the flats *E* on die-block *B* are parallel with the machine spindle. When this is done, the piece is ready for drilling hole *C*. After the hole *C* has been drilled, twenty turns of the dividing head will locate precisely the place to spot, drill, and bore the bushing hole *D*.

The die operates as follows: On the down stroke of the press ram, punch *F* breaks through the shell at *G*. Then punch pad *H*, having the same radius of curvature as the circular portion *I* of block *B*, comes in contact with die-block *B* at point *J*, forcing *B* downward against the coil spring *M* until the shell is pierced by punch *K*. As the ram ascends, due to the action of the coil spring *M*, die-block *B* rises into position for the next shell. No stripper is necessary. Slugs are emitted through the tapered hole *L*.

Adrian, Mich. FRANK V. KEIP



Holding Forged or Cast Shaft by Floating Polygonal Nut (Upper View), and by Floating Pin (Lower View)

MACHINING SHAFTS WITHOUT DOGS

When shafts, such as those shown by dot-and-dash lines in the accompanying illustration, are forged or cast with a hollow head to reduce weight or material, the use of a polygonal hole instead of the conventional circular one will provide a means of driving the piece without dogs during subsequent machining operations. For small work, either a hexagonal or an octagonal opening usually suffices, but as the diameter increases, more sides can be used. The idea is to employ a shape that will closely approximate a circle and still give enough of a flat to prevent the piece from turning while the cut is being taken. By allowing the driver to float, the tendency to crowd the piece off the center, which is likely to happen when the hole is not concentric, is eliminated, and various sizes of work can be accommodated without removing the center from the spindle.

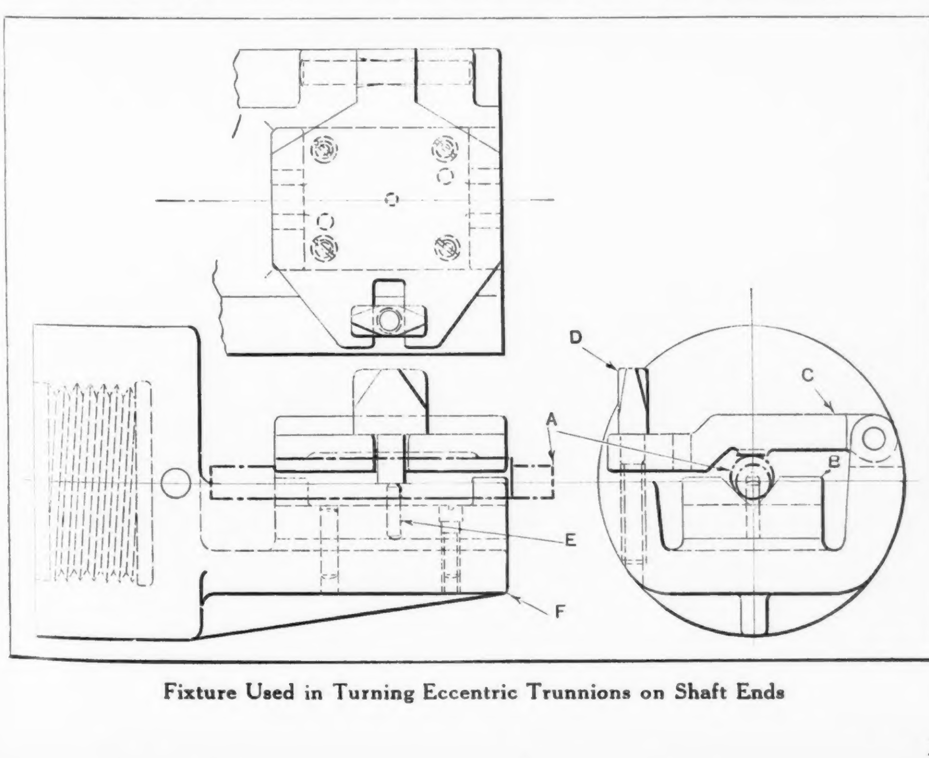
Another method, shown in the lower view of the illustration, which also permits taking all exterior cuts at one setting, is to incorporate two slots in the end of the piece, centers with a floating pin being provided to drive the work. This is often satisfactory, but it has the disadvantage of reducing the bearing surface and also mars the appearance of the finished part somewhat by leaving two open spaces.

South Plainfield, N. J. H. C. KLINE

TURNING SHAFTS WITH ECCENTRIC TRUNNIONS

The method here described, for producing fairly large quantities of shafts with eccentric trunnions on both ends, has been found very satisfactory. The shafts are first cut off from bar stock to the correct over-all length. A radial locating hole is then drilled equidistant between the points at which the shoulders of the trunnions are to be machined.

The monitor type fixture used on a hand screw machine for holding the shafts while turning the trunnions is shown at *F* in the accompanying illustration. The shaft or work *A*, indicated by the dot-and-dash lines, is held in the proper radial position by means of the pin *E* which projects into the drilled hole. The V-block *B* is properly located to give the correct amount of offset or eccentricity to



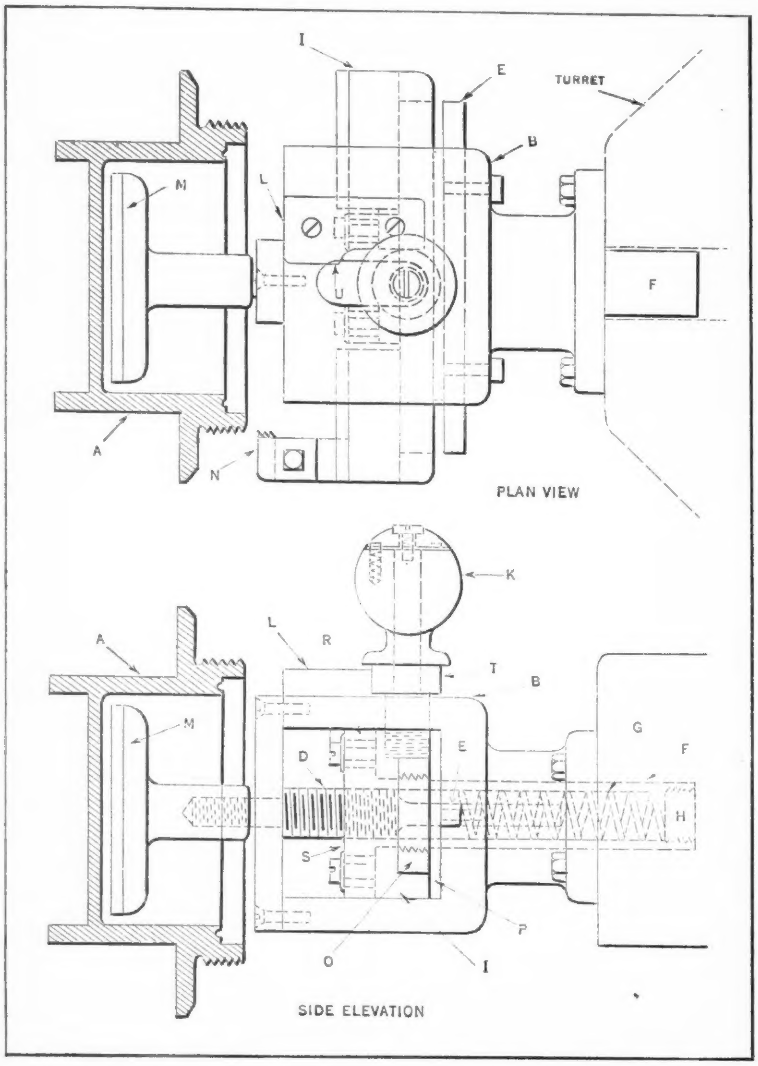
Fixture Used in Turning Eccentric Trunnions on Shaft Ends

the trunnions. The shafts are held in place by a hinged clamp *C* and the thumb-screw *D*. After one end of the work has been rough-turned and finished with a box-tool, the opposite end is machined by the same tools without changing their settings.

Dayton, Ohio W. P. GALLAGHER

THREADING TOOL FOR TURRET LATHE

The tool here described was developed for threading the aluminum cases of air-speed indicators, which are used to determine the speed of airplanes by measuring the difference in air pressure on each side of a flexible diaphragm. It is important that the threads on these instruments be air-tight. Plan and side elevation views of the threading tool designed for cutting these threads are shown in the accompanying illustration. One of the indicator cases is shown at *A* in the position it occupies when being machined.



Tool Used on Turret Lathe for Threading Aluminum Cases

In cutting the threads shown on the outside of the case, the operator advances the turret to the required position and pushes the knob *K* away from him to engage the lead-screw incorporated in the tool. At the end of the cut, the threading tool is automatically thrust out of contact with the work and returned to the starting position. Knob *K* is then turned or twisted a fraction of a revolution, where it is held in position by a spring-backed ball, which is forced out into one of the several recesses. This sets the tool for taking the second cut. Then knob *K* is again pushed over, and the tool takes the second cut. The thread is cut to the required depth by taking three cuts in this manner.

Referring to the illustration, *B* is the cast-iron body of the tool, which carries a short lead-screw *D* for cutting thirty threads per inch. The lead-screw is in line with the lathe centers, and is supported by bearings in the body of the tool. At the front end of the lead-screw is a friction disk *M*, which is held by friction to the base of the indicator case *A* when the turret is fed forward into the operating position. This arrangement causes the lead-screw to rotate with the work at the same speed.

The rear end of the lead-screw is supported in a pivot bearing in cross-bar *E*, which passes through a slot in the tubular member *F*, the latter member fitting freely in the tool hole of the turret. A spring *G*, which presses against the cross-bar *E* at one end and against plug *H* at the other, normally forces the tube *F* back into the hole in the turret. To the forward end of tube *F* is attached a tool plate *I*, which slides in top and bottom guides in the body *B*. On the front end of plate *I* are two half-nuts *S* and *R*, arranged to engage or clear the lead-screw *D* as required.

The stem of handle *K* passes through a slot in casting *B* and is fixed to plate *I*. An eccentric collar *T* on handle *K* slides along a fixed steel guide bar *L*. The depth of cut can be varied by twisting knob *K* to bring the eccentric collar into the required position. Successive cuts of increasing depth can be taken by simply twisting the knob after each cut. The knob is provided with a check ball and spring which indicates the change in the depth setting and also holds the knob in position.

When the turret is brought forward, the friction disk *M*, coming in contact with the work, causes the lead-screw to revolve. The turret-slide is then locked in place, and handle *K* pushed back or away from the operator to bring the front half-nut *S* into contact with the revolving lead-screw. This causes the tool *N* to feed forward at a definite rate and cut the thread on the case *A*. The half-nut is thrown out of engagement at the end of the cut by a small cam surface at *U* near the end of the guide *L*. When the eccentric collar of handle *K* reaches the cam surface, the handle is forced back, so that the lead-screw nut is disengaged, permitting spring *G* to move slide *I* and tool *N* back to the starting position.

Handle *K* is then twisted to bring the lower part of the eccentric collar in contact with the guide *L*, thus allowing tool *N* to take a deeper cut. Internal threads required for the brass bezel, which is used for holding the glass in position, are also cut with the same tool. To do this, the guide plate *L* is moved to the opposite side of handle *K*, and the

position of the tool-holder reversed, so that the threading tool is on the rear side of the tool body.

The operations, as described, may sound slow and cumbersome, but as the work runs at full turning speed, the three cuts are taken so rapidly that the eye can hardly follow the movements. In fact, the threading operation is the quickest of the five machining operations on the front side of the case, which total about 4 minutes per piece. It will be noted that no reversal of the lathe spindle is required with a tool of this kind. A plain lathe without screw-cutting appliances can be used. The tool is completely out of the way, except when it is actually in operation. The tool described, which was invented and used in the instrument works of Stuart & Moore, Acton, England, has also been adapted for various other threading jobs.

London, England — ROBERT JULIAN

REHOBBING WORN WORM-GEARS

The necessity for frequent replacement of the worm-gears used on a hand-saw blade grinding machine for raising and lowering the grinding wheel led to the rehobbing of the worn wheels in order to reduce replacement costs. The rapid wear of the worm-gears was caused by the abrasive action of the grit from the wheel. The worms, being of glass-hard tool steel, outlast three or four of the gears.

For rehobbing, the worm-gear is placed on an arbor and mounted between centers on a milling machine. The worm-gear hob is fed down until a new set of teeth is formed. The worn tooth spaces serve as gashes in starting the hobbing operation.

It is evident that the pitch diameter of the gear is reduced by the rehobbing operation without decreasing the number of teeth in proportion, and that a slightly thinner tooth will result, which will allow a small amount of backlash when meshed with the worm. However, this wear is not sufficient to cause trouble. The worm bearings are made adjustable, so that they can be moved inward to obtain full engagement with the gear. The gears can be rehobbed twice before it is necessary to discard them.

Fairfield, Conn. — J. E. FENNO

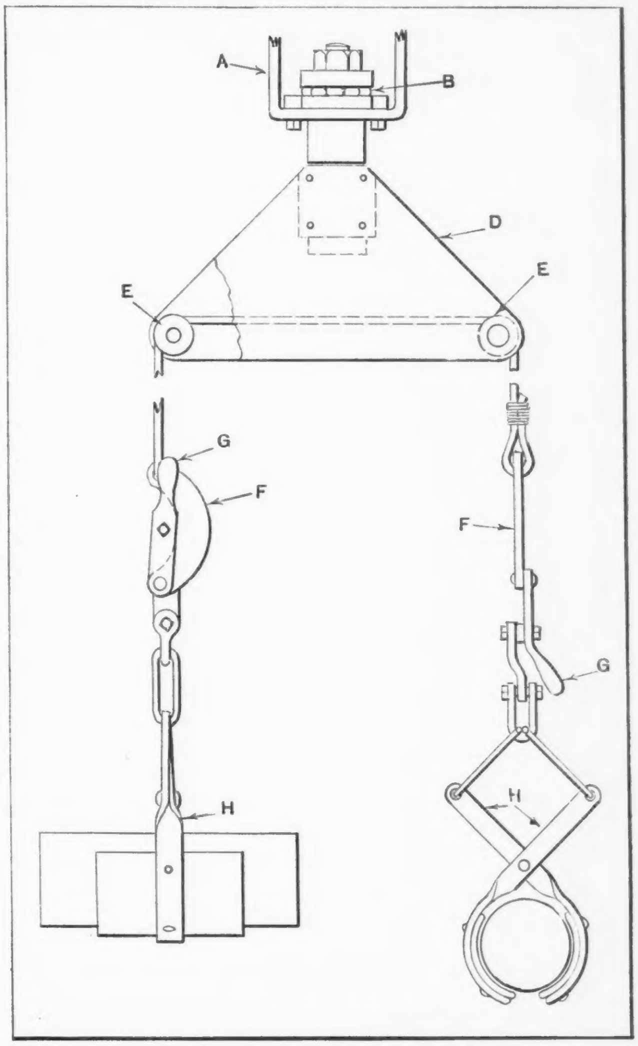
HANDLING HEAVY LATHE WORK

The handling of material is frequently an important factor in the production of parts, especially when the actual machining time is comparatively short in relation to the total floor-to-floor time. Much thought has been given to handling methods during recent years, and the time between actual machining operations is constantly being reduced in metal-working plants.

A device which was developed during the war for handling shells and has since been modified for handling short heavy shafts and castings is shown in the accompanying illustration. In this particular instance, a special conveyor was located at the rear of a lathe adjoining the shelf on which the stock was placed before and after machining.

The device shown is supported from overhead beams or a truss by the U-strap *A* which, in turn, supports the entire device by means of the ball bearing *B*. The triangular plates *D* are bolted together about the suspended shaft, and carry at each outer corner a roller *E* for supporting the lifting cable. The simple toggle lifts need little extension; the crescent piece *F*, being shaped to permit the pin in the center of lever *G* to pass over the vertical center line, locates and holds the lift in the upward position. A slight movement of the handle serves to release the load.

The lifting tongs *H* open freely when the load is released. When the device is in operation, the lift *H* at one side is attached to a finished piece,



Device for Transferring Work from Conveyor to Lathe Chuck

which, after being released from the machine chuck, is carried to the back of the lathe by swinging or pivoting the supporting triangular plate *D* on the bearing *B*. At the same time a new piece of work is carried to the machine from the conveyor at the rear of the lathe. — JIM HENDERSON

DIE FOR BENDING, STAMPING, CUTTING OFF AND PIERCING BRACKETS

Brackets like the one shown by the heavy dot-and-dash lines at *C*, Fig. 2, were made in the following manner previous to the adoption of the die in which the bracket is shown. First, the stock was cut to length. Then it was bent to the shape indicated at *C*, after which the holes were drilled. The final operations consisted of stamping the part

number on one side of the bracket and removing the burrs left by the drilling and cutting-off operations. It will be noted that only the two ends of the die and work are shown in Fig. 2. The middle section, not shown, contains two piercing punches, like the one shown at *D*, and a stamp for stamping the part number on the bracket. This section was eliminated from the illustration in order to show the essential details on a larger scale.

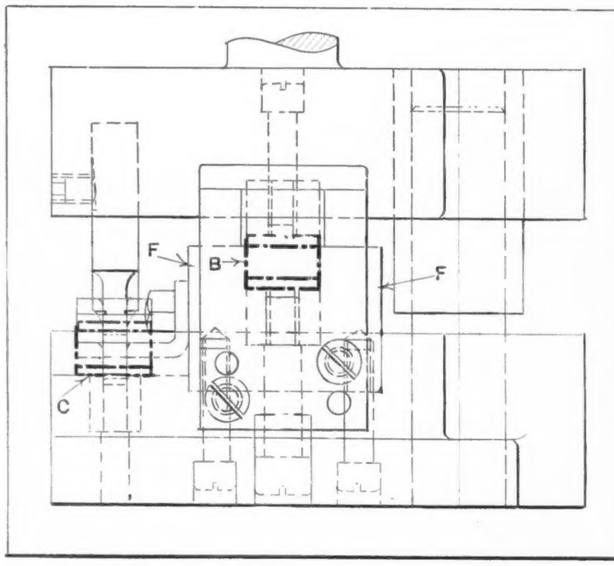


Fig. 1. End View of Die Shown in Fig. 2

When the die is in operation, the bar stock is passed through the opening in the bracket *E* and between two ways secured to the two hardened steel blocks *F*, Figs. 1 and 2, until the end reaches the outer edge of the lower cutting-off tool *G*. The operator then trips the press, and the descending punch member bends and stamps the first piece. When this is done, the stock is pushed through the die until the end of the formed part indicated at *A* is located by the stop *H*, after which the press is again tripped; on the second stroke, punch *K* cuts off piece *A* and bends the second piece, as indicated at *B*. The operator then places the cut-off piece in the position indicated at *C*, pushes the stock ahead again until it is located by stop *H*, after which he again trips the press. On the next stroke, the first piece, shown at *C*, is pierced. This finishes the first bracket, and in the same operation the second piece is cut off and a third bent to shape.

After the completion of the first bracket, a finished piece is turned out at each stroke of the press. The cost of producing the brackets on the die described is 2 cents per piece, as compared with 15 cents per piece by the old method of production.

In the end view of the die, Fig. 1, the work at *B* is in the bending position and that at *C* in the position it occupies when being pierced, as also indicated in Fig. 2. The spring plunger *J*, Fig. 2, prevents the stock from moving before the bending die begins the actual bending operation. The bending die and the punch are both made in three parts and fit in slots in their respective holders. The cutting-off punch is shown at *K*, Fig. 2. The usual strippers and other constructional details are incorporated in the various members of the die.

E. F. EBERHARD
Bridgeport, Conn.

FASTENING MACHINE TO CRATE

The accompanying diagrams illustrate one of those apparently paradoxical conditions wherein a faulty fastening arrangement was rendered satisfactory by weakening its construction. A concern manufacturing machines or devices in various sizes weighing from 50 to 500 pounds experienced a great deal of trouble from damage to its products through rough handling during transportation. The feet of the machines were often broken, the frames cracked, the shafts sprung, and the journal box set-screws sheared due to rough handling methods. After spending considerable time and money in trying to develop a method of crating that would overcome these difficulties, it was found that a simple change in the way the machine was fastened to the crate eliminated the trouble.

The crates, as originally made, consisted of hard pine skids to which the machines were solidly bolted, as indicated in the diagram at the left in the illustration. The usual crating structure was built up on the skids. It will be noted that large size bolts which entirely filled the hole through the ma-

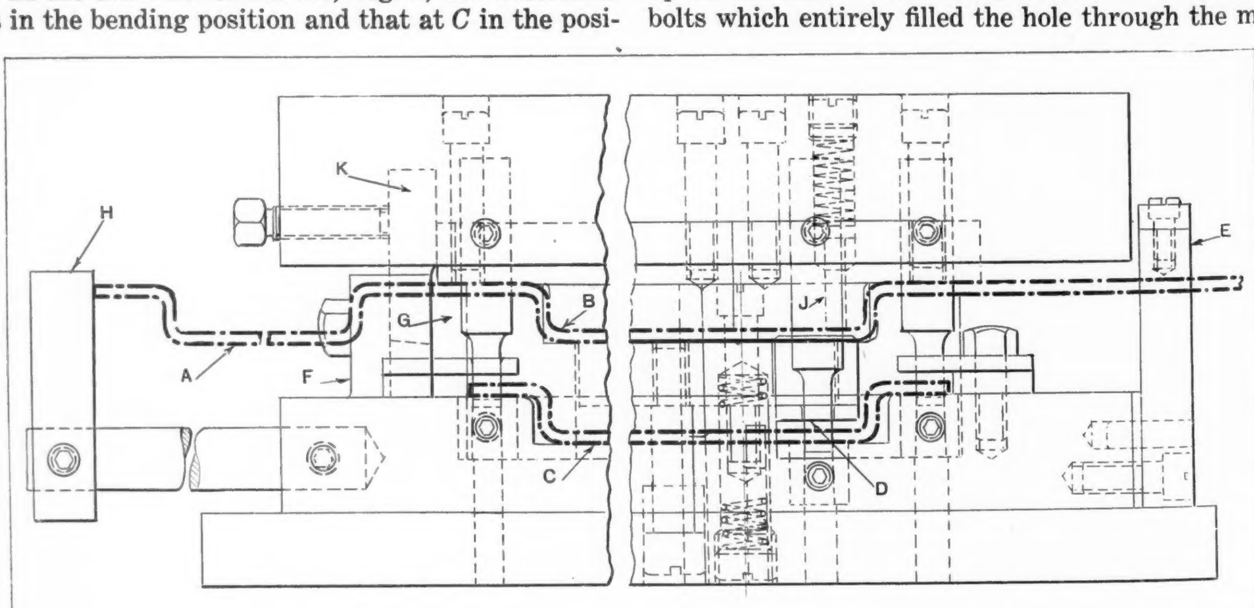
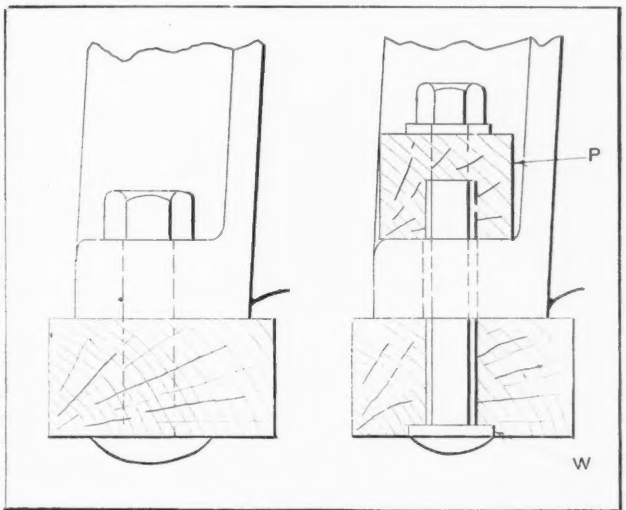


Fig. 2. Die Used for Bending, Stamping, Cutting Off, and Piercing Brackets

chine foot and skid were used. At the right is shown the improved method of securing the feet to the skids. In this case, spruce skids were substituted for hard pine because they are more resilient transversely. The cross-sectional area of the bolts was reduced 50 per cent and the length increased nearly 100 per cent. Hard wood packing blocks *P* were introduced between the nut of the fastening bolt and the top of the machine foot. The bolt clearances were made about as shown, the bolt being centered by the washer *W*.



Diagrams Showing Rigid and Flexible Fastening Methods Used to Secure Machine to Crate Skids

Briefly, the theory of the new arrangement, which proved very satisfactory, is as follows: By reducing the diameter of the bolts, a greater amount of deflection for the same fiber stress is permitted, and by using a longer bolt, this desirable quality is further increased. The large body clearances around the bolt permitted greater transverse deflection, thus tending to eliminate breakage.

As the bolt is flexed, its axial length is foreshortened, thus drawing the parts more tightly together. This constitutes an automatic brake, which serves to dissipate abnormal stresses before they cause damage, the braking or shock-absorbing action with this arrangement being proportional to the severity of the shock imposed. In testing out the construction, a 50-pound machine, crated and fastened as described, was allowed to drop from a freight car door to the ground. Both crate and machine withstood this test satisfactorily.

Willimantic, Conn. HERBERT A. FREEMAN

FIXTURE FOR MILLING PIECES HAVING A COMPOUND TAPER

The fixture shown in the accompanying illustration was designed for use in milling pieces like the one shown at *A*. The longitudinal taper corresponding to the angle *X* is produced by gradually elevating or raising the work while it passes between the cutters *G*, which are of the proper angle to machine the sides of the work to the required included angle *Y*. The base *E*, which is clamped on the milling machine table, is machined to the correct angle *Z* for raising the sliding block *D* the proper amount during its passage between the cutters *G*. The tangent of the angle *Z* equals *X* divided by *Y*.

The feeding movement of block *D* is obtained by means of screw *H* connected by the universal joint *I* with the shaft *J*. Shaft *J* is driven in the conventional manner through gearing connected with the longitudinal feed-screw. The feed-screw nut on the milling machine table is removed, and the table is securely clamped in a fixed position, so that the feed-screw drives the screw *H* on the fixture.

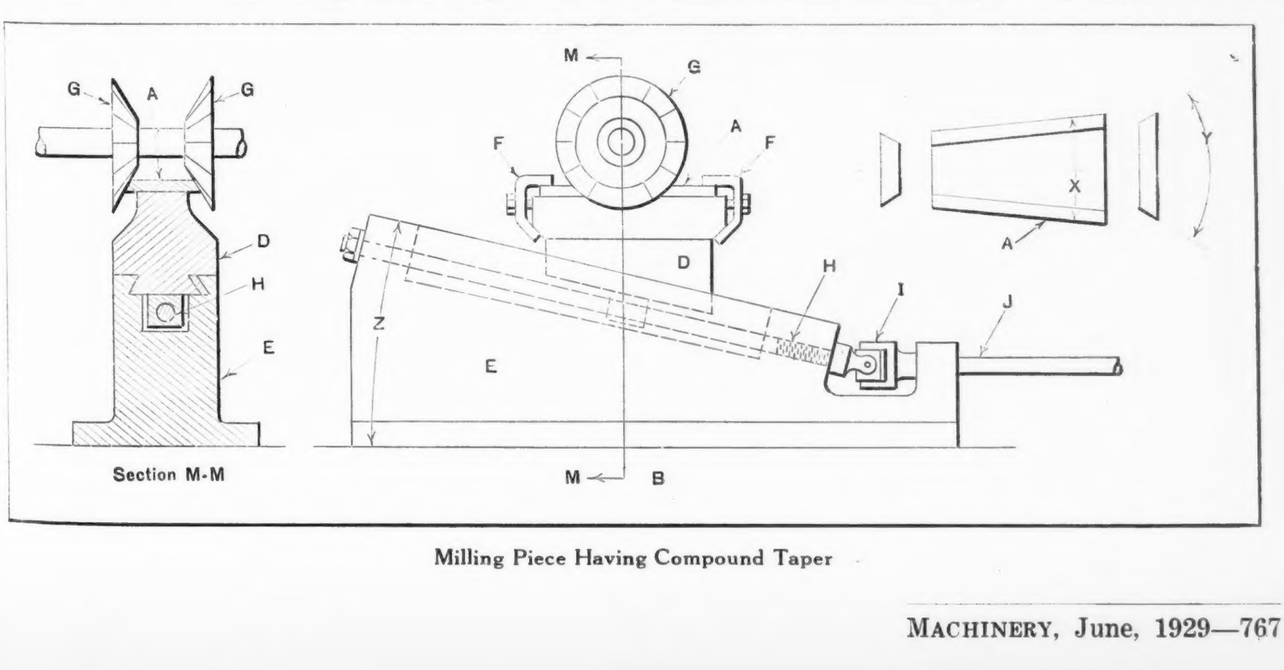
The work is held on the block *D* by means of the clamps *F*. The cross-section *M–M* shows how the block *D* is dovetailed and gibbed to the base *E*, in order to provide a good sliding fit. After the work has passed between the cutters *G*, the block *D* is returned by operating the longitudinal feed-screw handle.

Philadelphia, Pa. R. H. KASPER

TURNING SLIGHTLY CONCAVE ROLLS

Various guide rolls employed in paper- and cloth-varnishing machines are required to be slightly larger in diameter at the ends than at the centers. The object of making the rolls concave is to prevent longitudinal wrinkles in the center of the web, the roll action required being the reverse of that employed in crowning a pulley.

The concavity or curvature of the rolls is very slight, however, amounting to only about 0.01 inch



Milling Piece Having Compound Taper

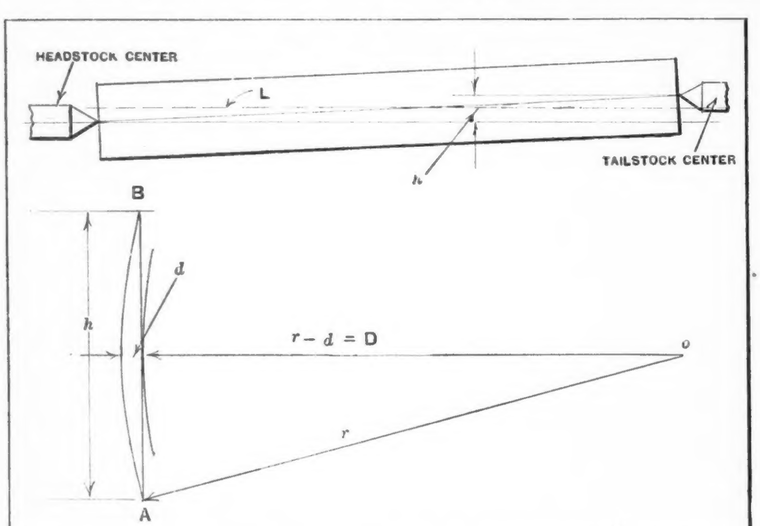
in diameter per foot of roll length. It is rather difficult to turn a curve of such a large radius by ordinary methods. The method to be described gives a curve which closely approximates that of a circle and is perfectly satisfactory for the purpose.

This method consists of blocking up the tailstock of the lathe and setting the point of the turning tool at a height half way between the center of the headstock spindle and the center of the spindle in the blocked-up tailstock. The line of travel of the tool is indicated at L in the upper view of the illustration. The amount of blocking required for the tailstock to produce the required curvature can be readily determined as described in the following. A diamond-point tool or a tool with an extremely small radius at the point and considerable clearance is used, a fine feed being employed. The cut will, of course, be taken above the center at the head end of the roll and below the center at the tailstock end, so that the ends of the roll will be turned to a larger diameter than the center.

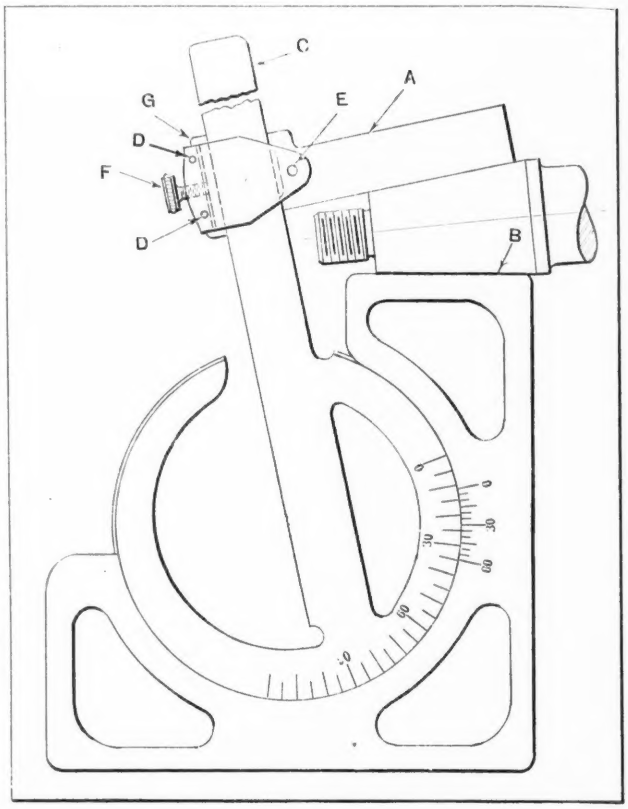
The amount h that the tailstock must be raised can be obtained either by construction or calculation. To obtain the height by construction, draw two arcs to a scale of 10 to 1 or larger, using radii equivalent to the maximum and minimum radii of the roll. These radii are designated r and $r—d$ in the lower diagram of the illustration. The length h of the chord tangent to the inner arc and intersecting the outer arc AB represents the amount the tailstock should be raised to obtain the required curvature, and can be measured. The scale measurement must, of course, be reduced to actual size; that is, if the diagram is drawn to a scale of 10 to 1, the scale measurement of h must be divided by 10 to give the actual height h indicated in the upper diagram.

In calculating the height h, we use the formula, $h = \sqrt{D^2 - d^2}$ in which d = the smallest diameter of the roll, and D the largest diameter. The method described will be found very convenient for turning slightly concave rolls in which the curvature must correspond closely to an arc of large radius. The curve actually generated by this method is a hyperbola.

Riverside, Ill. F. MARTINDELL



Diagrams Showing Method of Turning Concave Rolls



Draftsman's Protractor with Attachment for Measuring Tapers

MEASURING TAPERS WITH A PROTRACTOR

When making drawings of parts of machinery to be duplicated, the draftsman frequently finds it necessary to obtain the taper per foot of a part. A method of measuring the taper that has proved convenient and simple is to use an attachment, such as shown in the accompanying illustration, which may be clamped to the blade of a draftsman's protractor.

The edge B of the protractor must be square with the blade C when the zero graduations on the scales coincide. The attachment is made largely of pieces of ground flat steel. The side pieces, with a spacer of suitable thickness, are riveted together at D. The extension arm of the attachment, which is machined to give a two-point bearing on the protractor blade, is connected to the side pieces by the single swivel-pin E. The arm is clamped against the blade C by tightening the screw F which thrusts the gib G against the back of the blade.

To gage the taper of a part, place one side of the part on the edge B of the protractor, then swing the blade C around and raise or lower the arm A until it makes contact with the opposite side of the part. Care must be taken to see that the arm A of the attachment and edge B of the protractor are in line with the axis of the part. Read the graduations for the measurement of the included angle. By consulting the table "Tapers Per Foot and Corresponding Angles" in MACHINERY'S HANDBOOK, the taper per foot can be obtained without any calculation.

Worcester, Mass. C. W. PUTNAM

FIRM BIDDING IN THE MACHINE INDUSTRY

By F. J. SHEA, Boston Gear Works, Inc., Quincy, Mass.

In these highly competitive days, it is vitally necessary that the purchasing agent know that the materials he buys are bought on the basis most favorable to his company, which means that the price paid for the proper material must be at least as low as that paid by other companies in the same line of business. Otherwise, there is set up a handicap in the way of a price differential which will be passed on, with the finished product, to his own sales department.

But how is the purchasing agent to know when the price asked is the correct one for him to pay? His principal guide is his years of experience and knowledge of the product. For example, suppose that the purchasing agent has a requisition from the shop to buy a machine tool. There are several manufacturers who make a suitable machine, and inquiries for prices are sent out.

Now there are many points that must be considered in the selection of a machine tool, and price may become a minor issue. The question of materials, workmanship, ease of operation, weight, power, accessibility for maintenance, service from the manufacturer, production figure guarantees, floor space, and time-saving features in design, all should have much more bearing on the decision of the buyer than price. The machine finally selected is usually one that the maker has guaranteed to do a certain task in a given time, with a definite degree of accuracy; and the manufacturer is so sure of his product that he is generally willing to make a guarantee to that effect, provided the buyer has a reputation for square business dealing. On this basis, the responsibility of the seller never ends, as actual guaranteed performance must be met and maintained not for an hour or a day, but month after month, through the guarantee period; and a fair price must include compensation for this service.

The statement is frequently made that the purchasing agent is responsible for beating down prices, and that "firm bids" should be made a rule in the industry, to prevent this practice. It is not quite right to place all the blame on the purchaser. In one case a purchasing agent, desiring to carry out an experiment in regard to firm bids, sent out inquiries on an important commodity for a year's requirements to a selected list of seven sellers, with a definite request that a firm bid be made by a certain date. All the bids, properly sealed, were on hand at the appointed time. Then, unsolicited, five of the selected list of sellers asked for an opportunity to revise their bids. When they had finished, there were twelve bids from seven firms, with the original bids still unopened; thus was his faith in the seller's willingness to adhere to "firm bids" shattered.

Firm bids simplify the business of buying and selling on some articles, but in general, the writer does not believe that this practice will prevail when given serious consideration by either the buyer or the seller. We are bound always to have price differentials, and a price that seems today to be cut as low as the seller dares to cut it and still be assured of a narrow margin of profit, will stand still closer paring down tomorrow when sales slow up due to a competitor's line selling just a little lower, or general business conditions making a price change possible or advisable.

* * *

Selecting the Right Cutting Lubricant

The importance of using the most suitable cutting lubricant in machining metals has only recently been thoroughly appreciated. An article on "Selecting the Right Cutting Lubricant," to be published in July MACHINERY, classifies lubricants according to their characteristics and gives information on the selection of the proper kind for specific purposes. When deep cuts are taken at low speed, for example, a cutting lubricant of great oiliness, such as a compounded mineral oil, is recommended. When a light cut is taken at a comparatively low speed, a cutting lubricant of low viscosity will give satisfactory results. When the cut is light but the cutting speed high, a large amount of heat is generated and a water-soluble oil-emulsion is generally preferred. Men responsible for results in machining metals, who want to be posted on this subject, will undoubtedly be interested in this article.

STANDARDIZED INSPECTION OF GEARS

The proposed American recommended practice for the inspection of gears has been completed by one of the sub-committees of the American Standards Association's committee on gear standardization. Copies of this proposed standard are now being distributed for criticism and comment and may be obtained by addressing C. B. Le Page, assistant secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York City. This proposed practice covering the inspection of gears, including worms, hobs, and cutters, was developed by joint action of the American Gear Manufacturers' Association and the American Society of Mechanical Engineers.

The recommended practice for gear materials and blanks, jointly proposed by the American Gear Manufacturers' Association and the American Society of Mechanical Engineers, has also been submitted to the industry for criticism and comment, prior to being submitted for final approval. Suggestions and comments are welcomed from men in the industry interested in this standardization work. Copies of this standard practice may also be obtained from the American Society of Mechanical Engineers.

* * *

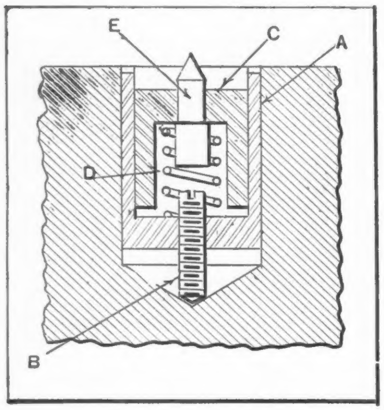
A plan whereby the shop employes of the General Electric Co. will receive vacations with pay has been announced by the company. Those who have been with the company continuously for three years or more will receive one week's vacation with pay, and those who have a service record of ten years or more, two weeks' vacation with pay.

To be eligible to a vacation, the employe must have a record of regular attendance during the preceding year. Absence of more than thirty working days during the calendar year preceding the year of vacation, for all personal reasons, shall be considered a break in the employe's regular attendance record.

Shop and Drafting-room Kinks

CENTER-SPOTTING PUNCH FOR BLIND DOWEL HOLES

The device shown in the accompanying illustration was designed for use in laying out blind dowel holes to match those drilled in the mating part. It consists of a metal sleeve *A* of the same diameter as the dowel, a headless adjusting screw *B*, and a sleeve *C*, which is a close sliding fit in sleeve *A*. In sleeve *C* is a tool-steel plug *E*, the upper end of which is hardened and ground to a sharp conical point. Supporting the plug is a stiff open helical spring *D*.



Spotting Punch for Blind Hole

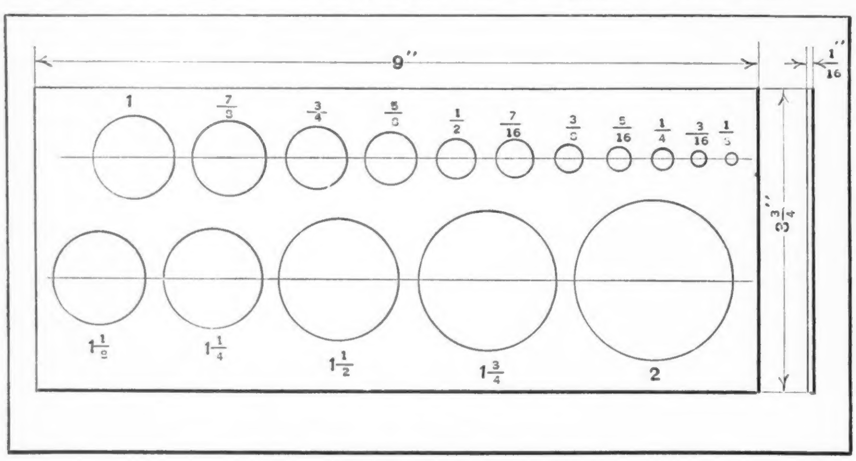
After the hole in one of the matching parts to be doweled is drilled and reamed, the spotter is inserted and adjusted so that the sleeve *A* is about 1/16 inch below the surface. The spring and the sleeve *C* carrying the punch or plug *E* are then inserted in sleeve *A*. The undrilled member or part is next chalked or blued, and placed in position on the drilled surface from which the position of the hole is to be transferred. This causes the plug *C* to be depressed so that spring *D* is compressed. The undrilled piece is then struck a smart blow with a hammer. This causes the punch *E* to produce a punch mark in the undrilled piece directly over the drilled hole in which the spotter is located. The sleeves *A* and *C* should, of course, be close sliding fits.

Willimantic, Conn. HERBERT A. FREEMAN

TEMPLET FOR DRAWING ARCS

In most drafting-rooms, tool drawings are made in pencil on "Vellum" tracing paper, which requires a heavy black line in order to produce a good blueprint. While heavy straight lines can be easily made, arcs produced with a compass cannot be made so uniform nor so heavy as the straight lines, because it is impossible to exert sufficient pressure on the compass. To overcome this trouble, the writer uses an ordinary pencil guided by a hole of the required diameter cut in a celluloid templet, such as shown in the accompanying illustration. The required amount of pressure can be applied to the pencil when using a templet of this kind for drawing arcs and circles.

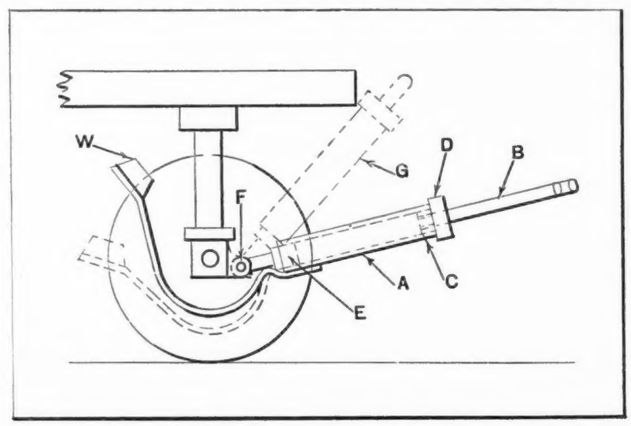
Bridgeport, Conn. E. F. EBERHARD



Draftsman's Templet for Drawing Arcs

BALANCED TELESCOPING TONGUE FOR TRUCK

A serious accident to one of the company's men, resulting from tripping over one of the old one-piece tongues of a hand truck, prompted the development of the telescoping balanced tongue shown in the accompanying diagram. The particular design shown was applied to a wagon or truck that was equipped with a locomotive jacket straightening plate. In the case of this truck, it was essential that the tongue be out of the way, so that the workman could walk around the plate without interference.



Telescoping Truck Tongue with Counterbalance

The telescoping tongue is made up of a piece of pipe *A* and an iron bar *B* having a handle at the outer end. On the inner end of bar *B* is pinned a collar *C* which prevents the handle from being withdrawn through the hole in the screw-cap *D*. A plug *E* secured in the end of tube *A* has a pivoted connection at *F*. The weight *W*, secured to a strap fastened to part *A*, overbalances the telescoping handle when the latter is not in use, causing it to assume the position indicated by the dotted lines at *G*.

Altoona, Pa. E. A. LOTZ

New Problems of the Machine Tool Builder

Meeting in Asheville, N. C., the National Machine Tool Builders' Association Discussed Standardization, New Cutting Tools, and Trend in Design

THE Twenty-seventh Spring Convention of the National Machine Tool Builders' Association was held at Grove Park Inn, Asheville, N. C., May 20 and 21. While the industry is enjoying an active business at present there are numerous new problems for the machine tool builder to solve, introduced partly by new conditions in the machine tool using industries and partly by the advent of new cutting materials that may require changes and modifications in machine tool design. These problems were dealt with extensively, both in the address of the president of the association, Henry Buker, of the Brown & Sharpe Mfg. Co., and in the report by the general manager, Ernest F. Du Brul.

Too Much Free Engineering Service is One of the Big Problems of the Industry

Referring to the subject of free engineering service, given by machine tool builders to present and prospective customers, Mr. Buker pointed out that the code of ethics of the Architects' Society requires that architects shall be paid for any plans or drawings they may submit, whereas formerly plans were submitted by architects in open competition, and only the man who won the award was paid.

In road construction and other large undertakings, it is the practice for the buyer to employ competent engineers to make all plans, so that all bidders may be in the same position, and may bid with a definite knowledge of what they are expected to furnish. Generally speaking, there is no reason why the same theory should not be followed out in the machine tool industry. While it is impossible to prevent some abuse of free engineering service, the fact remains that with every machine tool builder keenly aware of how much this service is costing, and with the whole industry trying hard to find a solution of the problem, there is hope that excessive free service will be eliminated gradually.

Along with the question of free engineering service, there is the problem of unlimited maintenance service. This problem is often complicated because the customer feels, and sometimes justly, that he is entitled to call on the manufacturer for assistance, because of some defect in design or in material of the machine furnished. Wherever it is self-evident that the customer and not the manufacturer is to blame, a charge should be rendered. If all machine tool builders would follow this practice, very few customers would question the fairness of such a position.

Standardization of Machine Parts

Mr. Buker further referred to the fact that standardization has occupied the attention of many machine tool builders in recent years. Back in 1903 the milling machine manufacturers reached an agreement as to the length of vertical, horizontal, and cross feeds for knee type machines. This was a very great step forward, as it eliminated the waste of making non-standard sizes and placing them on the market in competition with standard products. The same group of manufacturers has standardized the spindle ends of milling machines, which is working out in a manner very satisfactory to the users. The grinding machine manufacturers have also made some progress in standardizing the lengths and diameters that grinding machines will swing.

Of course, there is a danger that should not be overlooked in any program of standardization of parts. Under no condition should parts be standardized to an extent that will hamper progress in design. Sometimes, to develop a machine to meet the user's requirements, the designer must ignore all established standards in order to make a machine that will produce the greatest amount of work possible in the easiest and most accurate way. The moment standardization interferes materially with progress, it fails. This must be kept constantly in mind whenever the standardization of parts is discussed.

Connected with standardization, although not quite identical with it, comes the question of limiting the number of sizes of machines of certain types. Many sizes have a limited sale. They have been made to fill in the line, and in some cases, because competitors had similar machines which some one thought it desirable to duplicate. With good methods of cost keeping, nearly all machine tool builders know that some sizes they are making are unprofitable. Undoubtedly, most of them would be willing to cut out such lines if they thought that their competitors would do the same. Nearly all machine tool makers manufacture sizes that could be dropped to the advantage of the industry as a whole.

Too Many New Designs Place a Burden on the Machine Tool Builder

With the rapid changes that have taken place in the last few years, practically every machine tool builder has been obliged to change, sometimes in a very radical way, the design of machines he has manufactured. That many changes have been necessary in order to keep up with the times, goes without saying. However, there is a grave danger that, due to the desire to lead all competitors, the machine tool builder may go to extremes.

There is not a manufacturer but fully realizes the very great cost of bringing out a new design. Everyone has been faced, from time to time, with the problem of whether to bring out a new design or continue to make the old type for a few years

longer. There comes a time, of course, when a change must be made. But who is there wise or farseeing enough to tell just when that point has been reached?

The cost of drawings, jigs, fixtures, and tool work preparatory to manufacturing a new machine in many cases will amount to anywhere from $75,000 to $100,000. This cost the machine tool builder knows must be absorbed in a very few years, if he is not to lose money on the new design. Furthermore, the new design, in going through the shop, interferes with the production of other lines, for practically every new design has some problem of its own that requires close attention.

The manager of a business must give the keenest attention to this subject of design if he wishes to keep up with the times and yet not lose money. Each manufacturer should face, clearly, just what it costs him to change to a new design, and should try to learn beforehand all that is involved.

"I would not for one moment suggest that machine tool builders stand still on the question of design," said Mr. Buker. "I only think that, with the present radical tendency, we must all guard against making changes unless we are convinced, looking ahead to the future, that they are desirable from a financial standpoint. Any design that has real merit and will produce work faster or more easily than the old designs should be developed—if the market is sufficiently large to reimburse the manufacturer."

The Buyer Incurs an Obligation when Placing an Order and Cannot Cancel at Will

If all machinery builders fully appreciated the grave consequences that follow when orders are cancelled, after money has been spent for labor and material in order to deliver the machines on definite dates, they would take reasonable care to see that all orders are placed with a clear understanding with the customer as to his responsibility to take the machines when ready for shipment on the dates promised. If the manufacturer will only present the facts to his customers, and if he will insist on his rights and make the buyer realize that he has an obligation to fill, much can be done toward eliminating unwarranted cancellations.

Effect of New Cutting Tool Materials

In his report to the association, Mr. Du Brul called especial attention to the fact that the discovery and promotion of the new cutting alloys composed of tungsten carbide and other materials is bound to have a great influence on machine tool design. Using these alloys, any machine now employed at less than its full capacity can be utilized to a greater extent than at present. Some machines cannot now be run to their present limits of power and speed, using high-speed steel tools. With tungsten carbide tools they can be run faster, which will reduce the necessity of buying new machine tools in many cases. The new cutting alloys increase the capacity of the shop having machine tools of this character.

But in many other cases there must be changes in design. The new alloy tools work well only if they have adequate support and there is plenty of strength in the tool carriage. The ordinary toolpost or tool clamp is not sufficiently strong to give the necessary rigidity required for the best use of the tungsten carbide tools. In some cases, to give the best performance it is necessary to remove the cross compound slide of lathes and build up a toolholder directly from the tool carriage, with a solid bolster block and tool clamps.

It has also been shown that the tailstock center in common use on lathes is a source of trouble. It seems evident that some type of live center must be found to take its place, because there is no possibility of adequately lubricating the present type of center. No live center that has been tested so far has been equal to the job. The most serious objection to the live center has been chatter of the work. Chatter is fatal to the use of tungsten carbide tools, because they are decidedly brittle, and chatter breaks the edge.

Improvements in Power Transmitting Members

It seems practically necessary also to redesign the power transmitting members of many types of machine tools. To use the new alloys, more power must be transmitted to the cutting point of the tools. The rigidity of all power transmitting members is of prime importance. Gears must be smooth running, well balanced, and of ample strength. The power application should be made close to rigid support members, and never on a shaft midway between bearing supports.

At this time it is also well for the machine tool industry to take the steps necessary to avoid many of the unwarranted expenses that were incurred at the time of the introduction of high-speed steel. At that time, there was no definite information available to the machine tool designer on which he could base his new designs. It would seem to be the part of wisdom to find some way, in cooperation with users, to determine the fundamental conditions that must be met, so that expensive mistakes may be avoided. A few mistakes on the part of a very few companies would cost more than the full cost of an exhaustive research. How to finance this research and how to get it done is a problem, but its solution should be undertaken with the least possible delay.

The Second Machine Tool Exposition

At the meeting in Asheville, J. Wallace Carrel, of the Lodge & Shipley Machine Tool Co., chairman of the association's exposition committee, reported on the plans for the 1929 exposition, to be held September 30–October 4, in Cleveland (see page 800-A of this number of MACHINERY.)

Papers were read before the meeting by Alexander Wall, secretary of Robert Morris Associates, who has made a study of the balance sheets and operating statements of some twenty machine tool companies; by F. M. Feiker, managing director, Associated Business Papers, Inc., who discussed the work of the business paper in modern industry; and by W. H. Rastall, chief of the Industrial Machinery Division, Department of Commerce, who spoke on the outlook for foreign trade.

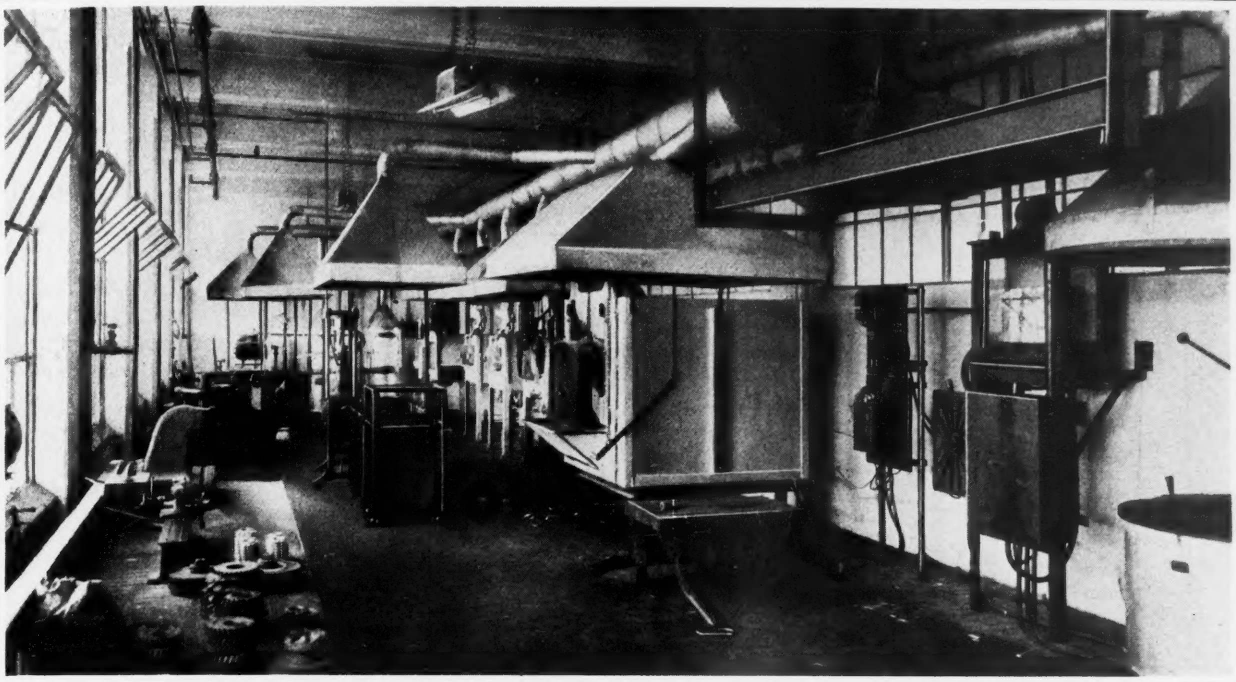


Fig. 1. High-speed Steel Heat-treating Room in which the Main Equipment Consists of Five Surface Combustion Gas Furnaces

Heat-treating Alloy Steel Machine Parts

Methods Used in the Heat-treating Department of the Barber-Colman Co. to Obtain Uniform Quality in a Varied Line of Machine Parts

By C. B. PHILLIPS, Vice-president, Surface Combustion Co.

AT the present time, the manufacturer has a great variety of steels at his command, and from these, if the proper heat-treatments are used, he can produce metal parts with almost any combination of physical characteristics. The choice of steels and the development of the best heat-treatments for the work in hand is of vital importance in the machinery industry. This is true in a marked degree in the business of the Barber-Colman Co., Rockford, Ill., which company manufactures machine tools—small and large—textile machinery, and a varied line of metal-cutting tools.

A well equipped laboratory is maintained at this plant. The functions of the laboratory include routine testing of incoming raw material, investigation of new steels and alloys, study of heat-treatments and properties of metals, and control of processes throughout the manufacturing routine. Every piece of steel coming into the plant that calls for heat-treatment is given a number, and a sample is cut from it, which is given the same number and tagged with a report card. The sample, on arriving at the laboratory, is etched to show defects, such as cracks, porous center, or segregation; and it is analyzed chemically to ascertain if it meets the specifications, tested for hardness, and examined microscopically. If the sample is a high-speed or tool steel, it is hardened in gas furnaces and examined in the hardened condition for physical defects and grain structure. The average time for a test is two days. Not until the report card is filled out and marked O. K. is the raw material put in stock.

The metallurgical test determines the properties of the material and how to heat-treat it, and ascertains what the reactions will be under different treatments. It is also referred to later to show whether good or poor practice has prevailed in the subsequent treatment of the steel. Of particular interest in this department is the Leitz micrometallograph used in the study of the grain structure of metals. Photomicrographs can be made with this machine with magnifications up to 2000.

Kinds of Steels that have been Found Most Serviceable

The alloy steels used in this plant may be divided into two classes—alloy structural steels and alloy cutting tool steels. The first includes those steels containing nickel, chromium, and chromium-nickel. The nickel steels 2310 to 2325 S.A.E., are used for carburized parts, and those from 2325 to 2340 S.A.E. are used for heavy-duty forgings. Other heat-treated parts are made from S.A.E. steels 2340 to 2350.

The S.A.E. 2500 series with from 0.10 to 0.20 per cent carbon are used for carburizing where the requirements are severe. One of the advantages of this material is that the heat-treating temperature is 1350 degrees F., and the product may be air-cooled, which reduces warpage. The nickel-chromium series S.A.E. 3120 to 3140, are also used for carburizing purposes, for such parts as machine

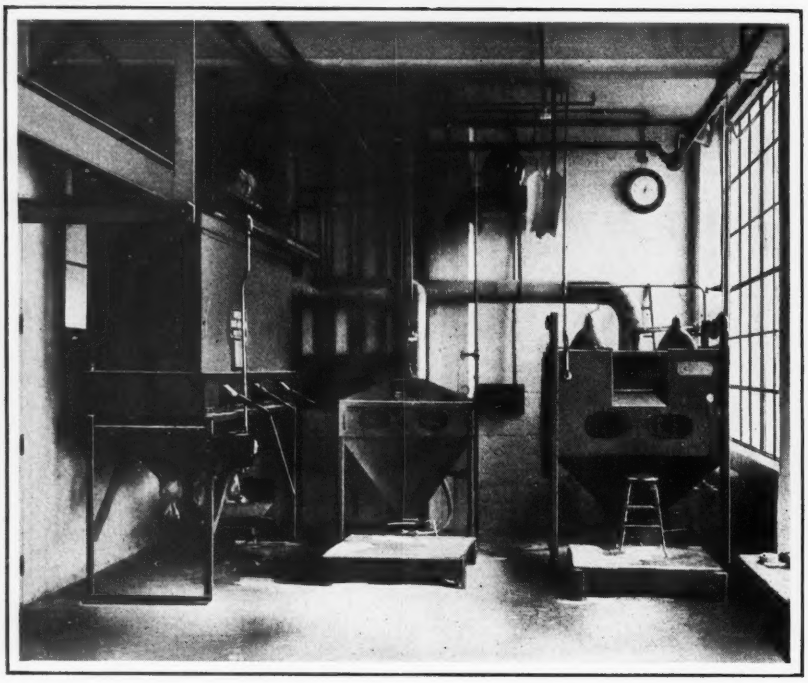


Fig. 2. Sand-blasting Equipment at the Other End of the Hardening Room Shown in Fig. 1

tool gears. The 3200 series is used where particularly high tensile properties are required.

Chromium steels of the 5100 and 5200 series which are used extensively in the making of steel balls for ball bearings, are coming into greater use in this plant. Aside from their shock resisting properties, they are also susceptible to heat-treatments which render them glass hard. Chrome-vanadium steels are also used. They are divided into two classes, one being used for general purposes, such as springs, etc., and the other for special tool steels. These are known as the S.A.E. 6100 series.

Examples of Heat-treatments

A part made from this last series (S.A.E. 6150), is a shaft for a warper, and while this part is only 7/16 inch in diameter and 18 inches long, it must stand a 90-pound pull without taking a set. This is heat-treated at a temperature of 1550-1570 degrees F., quenched in oil, and drawn at 725-750 degrees F.

For speed gears, S.A.E. 3120 steel is used. The heat-treating process is as follows:

1. Normalize at 1650 degrees F. and air-cool to eliminate forging strains.
2. Anneal at 1450 degrees F. and cool slowly for machineability.
3. Machine and rough-hob.
4. Carburize at 1650 degrees F. for five hours, for 1/32 inch depth of case.
5. Quench in oil to toughen core.
6. Anneal at 1400 degrees F. and cool slowly.
7. Finish-hob, removing 1/64 inch to correct distortion produced during carburizing.
8. Harden at 1425 degrees F. and quench in oil to refine case.
9. Draw in oil at about 425 degrees F.

Furnaces Used in the Forging Shop

In order to maintain control over all parts, all forgings are made at this plant. The forging shop is equipped with hammers ranging in capacity from 3/4 to 2 1/2 tons, which are served by gas furnaces. Two of these are 4 feet in all three dimensions and are used for preheating and heating, respectively. They are heated with three gas burners to a side, and these are manifolded to inspirators which correctly proportion the gas-air mixture for perfect combustion and correct furnace atmosphere, to minimize scaling. There are several other forging furnaces up to 6 feet in length, all fired with the Surface Combustion Co.'s system.

All the small tools are made from forgings produced in this department; the short ends of the billets are utilized by drawing them into tool bits. These tool bits are given the utmost density by hammering.

Control in the heat-treating department starts at the foreman's office where each part is tagged with one of three cards: White for mild steels, requiring carburizing or cyaniding; yellow, for tool steels, or those that will harden by direct quenching; and red, for high-speed steels. These cards are filled in from those sent with the parts from the planning department, which designates the kind of heat-treatment. The foreman notes the specifications and fills in the temperatures and periods from a card-index of heat-treatments supplied by the laboratory.

The High-speed Steel Heat-treating Department

The high-speed tool hardening department (see Fig. 1) consists of a big room containing practically every kind of equipment for efficient work. Along one side of this room are five Surface Combustion Co.'s gas furnaces, all about 4 feet in all three dimensions. These are fired with three gas burners to a side, manifolded to inspirators by which a reducing, neutral, or oxidizing atmosphere is obtained. They are equipped with automatic temperature controls and recording pyrometers. Another furnace, of slightly smaller dimensions, has one burner firing along the arch and the other under the hearth. In addition, there is an oil bath for drawing, and two lead baths, fired with spider burners. There are two oil and one water quenching tank. The oil is kept cool by recirculating through a cooling reservoir, while water, running continuously, serves to keep the temperature low in the water tank. There are also three electric furnaces for stand-by purposes in this department.

A pièce that represents an especially delicate job of heat-treating is the selector used in textile machinery for picking out threads for knotting. This is comparable to the finest watch work, and the point is very much sharper than the finest sewing needle. It is provided with a hook filed and lapped by hand. This selector is placed in a sealed holder and then put into the furnace, where it is heated to 1400 degrees F., quenched in sperm oil, and drawn at 425 degrees F. on the hook and 660 degrees F. on the shank.

Equipment of the General Heat-treating Department

The general heat-treating department is much larger than the high-speed tool hardening section, and there is a much greater variety of equipment. On one side wall are arranged five large furnaces which can be used interchangeably for various kinds of heat-treatment. These vary in size from 10 by 4 by 45 feet to 5 by 5 by 3 feet. Three of these are gas-fired to provide convenient and adequate means for atmosphere control. The largest gas furnace in this group is under-fired, with twelve gas burners on each side, while the others have only seven gas burners to a side. These are all manifolded to inspirators for the correct proportioning of the gas-air mixture.

There are three rotating carburizing furnaces of the tilting type, all fired with gas. Instead of using the ordinary carburizing material in these furnaces, gas is passed through while the work is in process, and thus the same kind and depth of case is obtained as by the older method. The parts so treated are very thin and delicate and would be damaged if rotated with the usual carburizing compounds. A very accurate control over the depth of the case can be obtained with gas by modifying the time element. The Barber-Colman Co. expects to use this method of carburizing with the box type furnace, in place of packing the work in boxes.

At the other end of the room is a battery of ten gas furnaces, ranging in size from 18 inches to 4 feet square. A lead pot with four gas burners, and two cyanide pots with two burners each are located nearby. In another group is a nitrate pot and two lead pots, gas-fired, while various quench tanks are located at convenient points. Three of these in front of the rotary furnaces are 9 feet in depth.

For reheating carburized work, a group of four oven-type furnaces is used, 3 feet in all three dimensions, and each fired with four burners to a side. All of these furnaces are wired to a common switchboard and indicating pyrometer. Parts treated in this department range from those so small that it takes 2000 to a pound up to forgings weighing from 200 to 300 pounds each.

* * *

METHOD OF PREHEATING CASTINGS BEFORE WELDING

The preheating facilities necessary in any welding shop or department naturally depend upon the nature of the work handled. Cast iron welding forms, perhaps, a major part of the average welding shop's daily work, and it pays the shop manager to give close study to the preheating problems encountered in the various types of castings. Small pieces can be preheated by the oxy-acetylene blowpipe and welded without much difficulty. This method, however, is impracticable for larger pieces. A blacksmith's forge is sometimes used for certain pieces, but with this, there is the possibility of burning the metal on one side, if constant care is not exercised.

The most economical method of preheating large pieces, particularly where the entire casting is to be heated, is by the use of a temporary firebrick furnace. This is built of loose firebrick laid without mortar. It is quickly constructed and can be built to any size desired. The accompanying illustration shows a large preheating furnace encasing a heavy iron casting. Asbestos paper, having holes for draft if necessary, forms the top of the furnace. The spacing of the bricks around the base assures sufficient draft to raise the piece to the proper temperature.

In order to maintain the desired temperature, the fire must be regulated occasionally while the welding progresses. This is done by opening or closing the draft holes, rearranging the asbestos paper covering, moving hot coals from one place to another, or replenishing the fire whenever necessary. This important detail is usually performed by a helper. When the casting has reached an even, dull red heat, an opening is made in the asbestos paper cover just large enough to uncover the weld area, and the welding is done through this hole.

After the weld is completed, it is just as important to secure proper cooling. The entire casting or piece should be covered with fresh charcoal and brought up to an even heat. With the asbestos covering intact, the finished work should be allowed to cool and contract evenly in the dying fire. It is important not to let one part cool quicker than any other. If this happens the piece may crack, due to an uneven internal stress.

Preheating and annealing of cast iron is an essential part of welding technique. It is not a difficult feature, because the methods of constructing the preheating furnace and governing the preheating temperature are easily understood.

* * *

According to an article by F. E. Dayes, chief engineer of the American Car & Foundry Motors Co., published in *Inco,* brake-drums made of a nickel alloy cast iron have operated satisfactorily for 50,000 miles without overhauling. This alloy cast iron has a fine, dense, uniform grain with a 260 Brinell hardness.

Temporary Firebrick Furnace, Built Around Casting, for Preheating Previous to Welding

Current Distribution Problems in Industry

Some of the Important Subjects Discussed at the Annual Convention of the National Supply and Machinery Distributors' Association

TRADE practices; standardization and simplification; lack of adequate profits of tool, supply, and machinery distributors; resale price legislation; sales promotion methods; and sale of machinery on the deferred payment plan were some of the problems of the tool and machinery distributors that were discussed at the twenty-fourth annual convention of the National Supply and Machinery Distributors' Association held at Atlantic City May 7 to 9. This meeting was held in conjunction with the annual meetings of the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association.

In his annual address, the president of the National Supply and Machinery Distributors' Association, E. P. Welles, president of Charles H. Besly & Co., Chicago, Ill., stressed the importance of the services and functions of the tool and supply distributor. He called attention to the changes that have taken place in industry and how almost overnight the problems of many plants have changed from those of production to those of distribution.

A New Era of Distribution

"Today, buyers are demanding an entirely new type of service," said Mr. Welles. "They require that someone maintain convenient sources of supply upon which they can draw for their daily requirements. Delivery of small quantities must be made promptly to meet their needs and to enable them to maintain their own business on an efficient basis. It is true that the small order has brought new problems with it, but it is also true that manufacturers cannot efficiently meet the service demands of buyers when they endeavor to sell direct.

"To accomplish the distribution of mill supplies satisfactorily, and at the smallest possible cost to manufacturers and industrial buyers, requires the services of those who are just as skilled in their art as the expert technicians of the manufacturers."

Mr. Welles further advocated more thorough cooperation between manufacturer and distributor. In pointing out how the manufacturers can aid the distributor in many ways, he suggested the following: First, the adoption of a policy of dealer distribution that is all the name implies. Second, the suggestion and maintenance of resale prices that provide a margin which will give the distributor a fair and equitable profit. Third, discontinuance of the practice of using so many outlets that it is impossible for anyone to secure a satisfactory volume of business. Fourth, placing distributors in all sections of the country on the same basis.

Trade Practice Conferences

One of the principal addresses at the meeting was made by M. Markham Flannery, chairman of the Trade Practice Conference Division of the Federal Trade Commission. Mr. Flannery briefly outlined the methods of the so-called "trade practice conference," a means that has been developed during recent years for the regulation of industry, permitting cooperation between industry and government, but placing industry in the position to make its own rules for the conduct of its business.

Briefly, the trade practice conference consists of a meeting of a majority of the men engaged in any one industry with a government official, for the purpose of formulating rules to govern that industry. The manufacturers or dealers engaged in the industry adopt their own rules, by which the competitive side of their business is to be governed. These rules define certain objectionable practices, and those engaged in the industry agree to stand by the rules thus formulated, and to aid in enforcing the rules within the industry. So far, sixty trade conferences have been held in as many different industries. The kind of rules adopted are simply those which any fair-minded business man is willing to subscribe to. A good example of a trade practice conference and its results is that of the woodworking machinery manufacturers (see MACHINERY, March, 1929, page 537). Industry in general is more and more recognizing the value of this method of setting its house in order, and at the present time at least two or three trade conferences are held every month. The three associations meeting jointly decided to appoint a committee to consider the advisability of holding a trade practice conference for the mill supply trade.

Sale of Machinery on Deferred Payment Plan

In his report to the association, George A. Fernley, secretary-treasurer, called attention to the many activities of the association and the work done during the year. Among the subjects of general interest in the entire machinery industry was his reference to the sale of machinery on the deferred payment plan. In order to obtain accurate information on this subject, a questionnaire had been issued for the purpose of ascertaining the views of those members who had utilized that plan.

"The replies indicated," said Mr. Fernley, "that it is advisable to hold title until a machine thus sold is completely paid for, to obtain a substantial down payment, and to have a definite understanding as to when subsequent payments are due." A large majority of the members did not regard the deferred payment business favorably, but said that they had made such sales to meet competition.

The new officers of the National Supply and Machinery Distributors' Association elected for the coming year are: President, H. H. Kuhn, Hardware & Supply Co., Akron, Ohio; first vice-president, H. E. Ruhf, Cleveland Tool & Supply Co., Cleveland, Ohio; second vice-president, E. B. Hunn, C. S. Mersick & Co., New Haven, Conn.

MACHINERY'S DATA SHEETS 155 and 156

CAST-IRON PIPE FLANGES

Dimensions and Theoretical Weights, in Pounds, of Screwed Companion and Blind Flanges for Maximum Working Saturated Steam Pressure of 125 Pounds per Square Inch (Gage)*

Approved by American Standards Association

Nominal Pipe Size†	Diameter of Flange	Thickness of Flange (Min.)	Metal Thickness† (Min.)	Diameter of Hub (Min.)	Length of Hub and Threads (Min.)	Theoretical Weight (Pounds)	
I	O	Q	V	X	Y	Companion Flanges	Blind Flanges
1	4 1/4	7/16	....	1 15/16	0.68	2	2
1 1/4	4 5/8	1/2	....	2 5/16	0.76	3	3
1 1/2	5	9/16	....	2 9/16	0.87	3	3
2	6	5/8	....	3 1/16	1.00	5	5
2 1/2	7	11/16	....	3 9/16	1.14	7	7
3	7 1/2	3/4	....	4 1/4	1.20	8	9
3 1/2	8 1/2	13/16	....	4 13/16	1.25	11	12
4	9	15/16	....	5 5/16	1.30	14	16
5	10	15/16	....	6 7/16	1.41	17	20
6	11	1	....	7 9/16	1.51	22	25
8	13 1/2	1 1/8	....	9 11/16	1.71	31	42
10	16	1 3/16	....	11 15/16	1.93	45	63
12	19	1 1/4	13/16	14 1/16	2.13	63	88
14 O.D.	21	1 3/8	7/8	15 3/8	2.25	82	115
16 O.D.	23 1/2	1 7/16	1	17 1/2	2.46	105	160
18 O.D.	25	1 9/16	1 1/16	19 5/8	2.65	120	190
20 O.D.	27 1/2	1 11/16	1 1/8	21 3/4	2.85	150	250
24 O.D.	32	1 7/8	1 1/4	26	3.25	220	370
30 O.D.	38 3/4	2 1/8	1 7/16	....	....	...	620
36 O.D.	46	2 3/8	1 5/8	....	....	...	990
42 O.D.	53	2 5/8	1 13/16	....	....	...	1470
48 O.D.	59 1/2	2 3/4	2	....	....	...	2000

*Cast-iron standard flanges for 125 pounds pressure have plain faces.

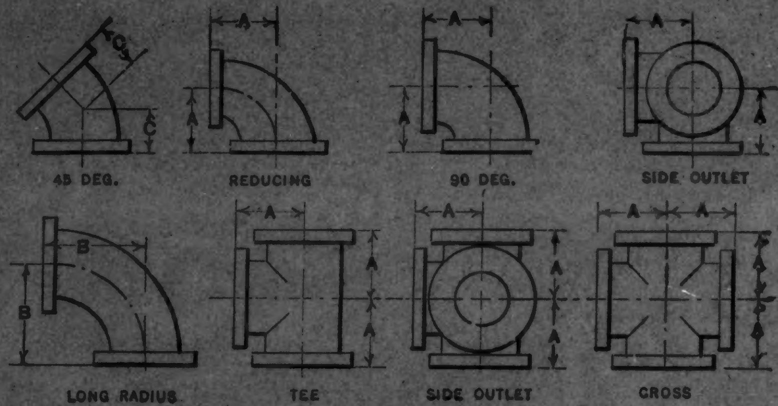
†Blind flanges for pipe sizes 12 inches and larger must be dished, with inside radius equal to the port diameter.

MACHINERY'S Data Sheet No. 155, New Series, June, 1929

CAST-IRON FLANGED PIPE FITTINGS

For Maximum Working Saturated Steam Pressure of 125 Pounds per Square Inch (Gage)

Approved by American Standards Association



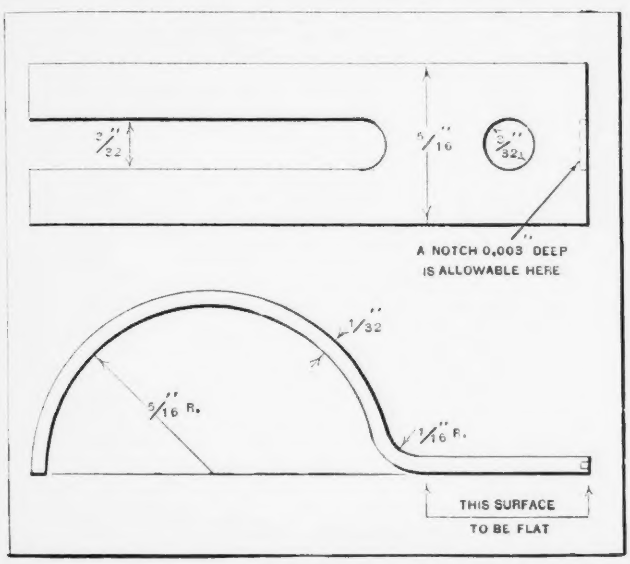
Nominal Pipe Size	Center to Face	Center to Face, Long Radius	Center to Face, 45-deg. Elbow	Diameter of Flange	Thickness of Flange (Min.)	Metal Thickness of Body (Min.)
	A	B	C			
1	3 1/2	5	1 3/4	4 1/4	7/16	7/16
1 1/4	3 3/4	5 1/2	2	4 5/8	1/2	7/16
1 1/2	4	6	2 1/4	5	9/16	7/16
2	4 1/2	6 1/2	2 1/2	6	5/8	7/16
2 1/2	5	7	3	7	11/16	7/16
3	5 1/2	7 3/4	3	7 1/2	3/4	7/16
3 1/2	6	8 1/2	3 1/2	8 1/2	13/16	7/16
4	6 1/2	9	4	9	15/16	1/2
5	7 1/2	10 1/4	4 1/2	10	15/16	1/2
6	8	11 1/2	5	11	1	9/16
8	9	14	5 1/2	13 1/2	1 1/8	5/8
10	11	16 1/2	6 1/2	16	1 3/16	3/4
12	12	19	7 1/2	19	1 1/4	13/16
14 O.D.	14	21 1/2	7 1/2	21	1 3/8	7/8
16 O.D.	15	24	8	23 1/2	1 7/16	1
18 O.D.	16 1/2	26 1/2	8 1/2	25	1 9/16	1 1/16
20 O.D.	18	29	9 1/2	27 1/2	1 11/16	1 1/8
24 O.D.	22	34	11	32	1 7/8	1 1/4
30 O.D.	25	41 1/2	15	38 3/4	2 1/8	1 7/16
36 O.D.	28	49	18	46	2 3/8	1 5/8
42 O.D.	31	56 1/2	21	53	2 5/8	1 13/16
48 O.D.	34	64	24	59 1/2	2 3/4	2

MACHINERY'S Data Sheet No. 156, New Series, June, 1929

Questions and Answers

PRODUCING STEEL CLIPS

S. B.—In the accompanying illustration is shown a clip made from non-tempered, hard-drawn flat steel stock, 1/32 inch thick. The production requirement on these clips is about 1,000,000 per month.



Clip to be Produced from Hard-drawn Steel Stock

It has been suggested that they might be profitably made by a rolling process, but some doubt is expressed as to the feasibility of such a method. The problem of applying the rolling process to the production of the steel clips is submitted to the readers.

Answered by E. A. Sisson, New Castle, Ind.

In my opinion, the making of the steel clips by rolling is a slow and costly method. A better way would be to use a progressive die which would pierce, cut, and form the clip in a continuous operation. The notch in the end could doubtless be modified by an indentation from either the top or bottom of the piece. In that case, it could be produced during the piercing operation. The die should be well made and fitted with guide pins to insure perfect alignment and to facilitate setting it up in the press. A No. 2 press running at 120 revolutions per minute ought to be satisfactory for this work.

CANCELLATIONS DUE TO FAILURE TO DELIVER ON SPECIFIED DATE

S. M. R.—Please state the law with respect to the rights of a purchaser to cancel an order for a machine when the seller fails to make delivery on the date specified in the contract of sale.

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

Generally speaking, the buyer is not obligated to accept delivery of the machine if the seller fails to fulfill any part of the contract. In other words, where either the buyer or seller breaks the terms of a contract of sale, the other party may legally refuse to continue with the agreement and may sue immediately for an amount equal to the loss he has sustained as a result, plus damages. Moreover, it is not necessary for the purchaser to notify the seller that he will not accept delivery after the date is passed on which delivery was promised. He may refuse to accept the shipment and demand damages.

DIP OR IMMERSION BRAZING

V. A. T. A.—Is there a progressive way of brazing small steel castings by first preheating the casting in one furnace and then dipping the portion to be brazed in a molten spelter in another furnace in such a way as to fill up small defects or cracks in the steel casting with the spelter?

This question is submitted to the readers of MACHINERY. If possible, give the temperature of the preheating furnace and the melting pot.

MAKING FLAT WASHERS IN QUANTITY

W. B.—What is the most economical way to produce flat washers in quantity? In a progressive die, there is a tendency for the washers to become cup shaped; how are they kept flat? In using a compound die, if more than three are made at one time, I have had difficulty with the washers dropping back on the die; also, the dies clog up because the washers stick to the top part. Can someone suggest means for overcoming these difficulties?

A.—Washers near enough to perfect flatness for most purposes can be made without difficulty in the following manner: Use a compound die with a positive knock-out, but do not bottom on the knock-out. Grind shallow grooves across the face of the knock-out sleeves, leaving slightly less than half the area flat. Apply cutting oil to the under side of the stock only. Incline the press just enough for the convenience of the operator. The washers will all be knocked out near the top of the stroke, and most of them will drop back on the top of the stock, but the operator soon becomes adept at tossing them off by a slight flipping of the stock; or they may be blown off by compressed air. The latter method is necessary when a roll feed is used. The number of punches is of no consequence, provided the stock is not too wide for easy handling.

ACCEPTANCE OF CHECK AS PAYMENT

Y. K.—A manufacturing plant ordered a large quantity of steel and iron, which was delivered in installments during the course of fourteen months. When delivery had been completed, the seller billed the buyer for a balance of $8000. The buyer disputed the correctness of this and contended there was only $7200 due. After considerable correspondence, and a failure to agree, the buyer mailed his check payable to the seller for $7200, and wrote on the check that it was tendered as "settlement in full" of the account. The seller cashed this check

and now seeks to recover the alleged balance of $800. Will the law allow the seller to collect?

Answered by Leslie Childs, Attorney at Law, Indianapolis, Ind.

The general rule is that when a check is tendered as settlement in full of a disputed account, its acceptance by the creditor will constitute payment in full. In other words, if the creditor accepts, he does so in the terms of the tender, and if he does not desire to accept it according to its terms, it is his duty to return it. He is not permitted to accept a check of this kind, apply it on the account, and then recover a balance alleged to be due. In the light of this rule, the seller of the steel will not be able to recover any balance claimed to be due. (181 Ill. App. 304).

MASS AND WEIGHT

H. L.—Although mass is defined in various textbooks on mechanics, the relation between mass and weight is not clear to me. Is weight variable and does the mass of a body have a fixed value? An explanation would be appreciated.

A.—The mass of a given body is a constant value by means of which the *quantity* of matter the body contains may be compared with that of another body. Mass is a ratio obtained by dividing the weight of the body by the acceleration due to gravity. According to the law of gravitation, the attractive force by which one body tends to draw another body toward it is directly proportional to its mass and inversely proportional to the square of the distance between the centers of the bodies. This attractive force is greatest at the earth's surface; above the surface it decreases as the square of the distance, and below the surface it decreases as the distance to the center decreases. With these fundamental laws in mind, the meaning of weight and the distinction between it and mass will be more apparent.

If the weight of a body is determined by scales of the beam or lever-balance type, a measure of the quantity of matter is obtained because the body balances a standard weight unit, and both body and weight unit are equally affected by gravity changes which would result either from a change of altitude or latitude; hence weight determined in this way is constant, regardless of locality. When a scale of the spring type is used, weight becomes a measure of the force of gravity and variations will occur, assuming that changes of altitude or latitude are sufficient to cause observable changes in the scale reading; hence the weight reading obtained with a spring type of scale might not be a true indication of the amount of matter, because with such a scale the force of gravity acts upon the body being weighed, but does not appreciably affect the spring resistance. If the weight obtained with the spring scale is divided by the acceleration due to gravity for a given locality, the ratio obtained, which represents mass, will remain constant.

To illustrate this point by using an extreme example, if the force of gravity is 32.16 (value commonly used in engineering) and the weight is 100 pounds, then the mass equals $100 \div 32.16 = 3.11$. On the surface of the sun, where the force of gravity is twenty-eight times greater than on the earth, the same body would weigh 2800 pounds, but its mass would equal $\frac{28 \times 100}{28 \times 32.16} = 3.11$. In this instance, there would be an extreme variation in the apparent weight, in pounds (assuming that the spring type of scale were used), but the ratio representing mass would be the same in each case.

The quantity of matter represented by a body weighing 100 pounds on the earth would not be altered in any way by a change of locality; hence, it is evident that the value representing mass is an indication of the quantity of matter that a body contains, and this is also true of the weight as determined by a scale of the beam-balancing type. When the term "weight" relates to the attraction due to the force of gravity, which is the common meaning in theoretical mechanics, mass is used in many calculations, such as those involving the motion of bodies.

Sometimes mass is expressed in pounds, but since it does not mean an equivalent number of standard weight units, but is a ratio between weight and acceleration due to gravity, the use of pounds in connection with mass is confusing.

USE OF SOLIDIFIED OIL

E. R. M.—The writer read with interest the article, "When and Where to Use Grease as a Lubricant," on page 92 of October MACHINERY, and would like to know in what way the so-called "solidified oils" differ from the greases described in the article.

Answered by H. L. Kauffman, Denver, Colo.

The term "solidified oil," as now used, is a general one that has no more meaning than the word "grease," and in the writer's opinion, it has even less, for "grease," in the commonly accepted meaning of the word, indicates a product made by thickening a mineral oil with a soap. Since almost all the so-called "solidified oils" contain a soap or combination of soaps, they are in reality only greases.

The writer has personally analyzed solidified oils that contain soda soap alone, calcium soap alone, and combinations up to 20 per cent, wherein the same variety of animal and vegetable oils were used as in the manufacture of greases. In some of the solidified oils analyzed, there was also an excess of free alkali, and in others, an excess of free fatty oil. Obviously, then, the term "solidified oil" as applied to soap-thickened mineral oil has no more meaning than the term "grease."

It is a fact, however, that some manufacturers of so-called "solidified oils" do employ a higher grade of fatty oil than some manufacturers of ordinary grades of cup grease, and that they purposely include a small percentage of fatty oil which, in some cases, is a hydrogenated oil. Also, that where soda is used in making the product, the resulting soap has a higher melting point and a lower coefficient of friction than the corresponding lime soap. In view of the foregoing practice, the cost of manufacturing some of the solidified oils is naturally greater than the cost of producing ordinary cup or lime-soap greases.

Standardization in the Gear Making Field

Many Problems of Gear Standardization, Including a Recommended Practice for Herringbone Gears, are Considered by Gear Manufacturers

AT the Thirteenth Annual Meeting of the American Gear Manufacturers' Association, held at the Hotel Statler, Cleveland, Ohio, May 16 to 18, a great deal of attention was given, as usual, to standardization activities. In addition, the meeting, which was one of the best attended in the history of the association, was addressed by a number of well-known engineers. The principal addresses were as follows: "Load and Stress Cycles in Gear Teeth," by R. V. Baud and R. E. Peterson of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; "Knowing your Costs," by Louis G. Goetz, manager of the factory system department of Nau, Taylor & Swearingen, Cleveland, Ohio; and two addresses, "Spiral Bevel and Hypoid Gears" and "Gear Geometry," by A. H. Candee of the Gleason Works, Rochester, N. Y.

Standardization Committees Present Reports Involving Much Original Study

Among the reports presented by the numerous standardization committees, several evidenced a great deal of painstaking work and study in the field covered. After a brief address of welcome by the president of the association, A. F. Cooke, a report on herringbone gear design was presented by the chairman of the Herringbone Gear Committee, A. A. Ross. This report contained a complete set of formulas and constants for the design of herringbone gears, logically arranged for the immediate use of the designer, and based upon the best available information in present practice. Those interested may obtain a copy of this report from the secretary of the association, T. W. Owen, 3608 Euclid Ave., Cleveland, Ohio.

The Worm Gear Committee presented, through its chairman W. H. Himes, a complete report on worm-gear nomenclature, and the Nomenclature Committee, Douglas T. Hamilton, chairman, a progress report on helical and herringbone gear nomenclature. Another comprehensive report was that of the Metallurgical Committee, of which Chester B. Hamilton, Jr., is chairman, on "Forged and Rolled Alloy Steels for Gears."

Load and Stress Cycles in Gear Teeth

In their paper on load and stress cycles in gear teeth, the authors, R. V. Baud, and R. E. Peterson, pointed out that it is quite generally known among gear designers that the number of teeth theoretically in contact may be one, two, three, or more, depending on the position of the teeth along the line of action, and also on the design of the gear. Thus, for example, one tooth of a gear may carry the load one-third of the time, and two teeth the remaining two-thirds. However, it must not be inferred that when two teeth of a gear are carrying the load, each tooth takes half the load. The distribution of load depends on the elasticity of the teeth and also on tip relief and tooth errors.

It was the purpose of this paper to present a method of solving the load division problem analytically, and also to determine by photoelastic tests some general stress relations for gears in which the number of teeth carrying the load varied. Some data bearing on this question have been published in the past, but no results have been available as yet in terms of load distribution and stresses; hence, this paper constituted an original contribution to the knowledge of stresses in gears. In connection with this paper, some motion pictures were shown, of celluloid gears subjected to stresses—the stress lines and areas being clearly visible.

Spiral Bevel and Hypoid Gears

In his paper on spiral bevel and hypoid gears, A. H. Candee dealt with recent developments in the design of machines for large spiral bevel and hypoid gears, and especially covered the advantages of hypoid gears in which the axis of the pinion is offset from the axis of the gear, so that the two shafts on which the pinion and the gear are mounted can be extended past each other. This paper was illustrated with numerous slides, showing gears of recent manufacture as well as the newly designed machines on which they are made.

In his paper "Gear Geometry," the same author emphasized the fact that a clear and accurate understanding of the geometric elements involved is indispensable to all who deal with the design, dimensioning, cutting, and measurement of gear teeth. The information presented in his paper had been collected and arranged with the idea of making the important geometrical relationships as easy as possible to comprehend, and with the intention of providing a sound basis for a thoroughly logical and complete system of gear geometry.

Importance of Good Cost Systems Emphasized

"If it is true that exact knowledge and the ability to apply it are essential to the advancement of the mechanical side of industry," said Mr. Goetz in his paper on the need for better cost systems, "it is still more true that exact information and the ability and knowledge of how best to use it are essential in business in the exercise of the managerial functions. The executive, who is responsible for guiding the destinies of a business, must not only know the physical capabilities and limitations of his plant, but must also be able to visualize these in dollars and cents, so that he can be sure that each dollar that is spent to produce and sell goods will return not only intact, but bring a profit along with it."

The information contained in adequate cost records is important because it is essential for accu-

rate estimates, for the setting of sales prices, for the determination of what business shall be bid on, and what shall be passed by, and finally, for the intelligent control of expense.

Many executives feel that the expense of maintaining a cost department is, at best, only a necessary evil, when as a matter of fact, that department has definite functions to perform and is just as important in its sphere as any other portion of an organization. The executive must cease guessing and deal with facts.

The following members of the executive committee were elected at the meeting: John Christensen, of the Cincinnati Gear Co.; W. H. Diefendorf, of the Diefendorf Gear Corporation; George L. Markland, Jr., of the Philadelphia Gear Works; E. S. Sawtelle, of the Tool Steel Gear & Pinion Co.; and B. F. Waterman, of the Brown & Sharpe Mfg. Co.

* * *

THE BRITISH METAL-WORKING INDUSTRIES

From MACHINERY'S Special Correspondent

May 15, 1929

With the General Election now imminent, the result of which it is practically impossible to foresee, it is only to be expected that an atmosphere of restraint will dominate industry during the intervening weeks. That the effect has not been felt more keenly up to the present bears witness to the virility of the industrial revival which has been noticeable since the beginning of the year, and there is every reason to hope that after the election further progress will be made.

The Machine Tool Industry is Well Employed

Opening on June 5, an exhibition of machine tools will be held in London by the Machine Tool Importers' Association, which comprises the principal importers of German machine tools. This exhibition will be held in conjunction with the Foundry Trades Exhibition, and provides an opportunity for the member firms to show German machines which are banned from the quadrennial exhibition held at Olympia under the auspices of the Machine Tool Trades Association.

Machine tool manufacturers are generally well employed, although it would appear that the volume of orders in hand is not quite so large as at the beginning of the year. Among the various types of machine tools for which there is a demand at present, mention may be made of planer type milling machines, horizontal boring machines, radial drilling machines, and chucking automatics.

Overseas Trade in Machine Tools Shows Slight Increase

The total weight of machine tools exported during March amounted to 1227 tons. This figure was slightly higher than the February total of 1219 tons, but considerably below the January exports, which totalled 1780 tons. On the other hand, the value of exports during March fell below that of February, the figures for the two months being £153,417 and £171,875 respectively, giving corresponding ton values of £125 and £141. By comparison it may be noted that the value of exports in January reached the exceptionally high figure of £247,260, with a corresponding ton value of £139.

The tonnage of machine tools imported during March was rather more than the February total, but slightly less than that of January. The figures for the three months, namely, 800 tons in March, 765 tons in February, and 847 tons in January, are remarkably consistent. The values of imports in these months were £135,207, £121,487, and £136,838, with corresponding ton values of £169, £159, and £162.

The Automobile Industry

Generally speaking, automobile manufacturers are working at high pressure, and in many cases are unable to keep pace with the seasonal influx of orders. Features of current business are the demand for very light cars and the comparatively high proportion of export orders, the latter, in one particular instance, absorbing fully 20 per cent of the total output. Closed cars are still very popular, and excellent sales of light six-cylinder cars are also reported. Like the automobile industry, the motorcycle trade is very busy.

Important Contracts have been Placed in the Electrical Engineering Field

The electrical industry, particularly the heavy sections, remains well employed. Among recent important contracts mention may be made of two orders placed with the Metropolitan-Vickers Electrical Co., Ltd. These cover equipments for extended electrification of the Buenos Ayres suburban lines of the Central Argentine Railway, and for the Northwestern section of the 132,000-volt transmission scheme of the British Central Electricity Board. These two contracts total £700,000 in value.

Another important group of contracts are those recently placed by the Sheffield Corporation in connection with a generating station, which is to be built under the Mid-East England scheme recently adopted by the Electricity Board. The value of these contracts is £542,901.

Largest Locomotives Ever Constructed in Europe to be Made for an Indian Railway

Judging by the increasing numbers of inquiries and orders received by machine tool builders specializing in railway shop equipment, it would appear probable that manufacturers of locomotives and rolling stock are experiencing better conditions than have prevailed for some time.

An interesting order has recently been booked by Beyer, Peacock & Co. Ltd., Gorton. This order, which is valued at approximately £230,000, has been placed by the Bengal Nagpur Railway, India, and comprises sixteen locomotives, each weighing not less than 232 tons. They will be the largest locomotives ever constructed in Europe, and will be of the Beyer Garratt articulated type. Each engine has a capacity for 10,000 gallons of water and 14 tons of coal. The boiler pressure of 210 pounds per square inch is the highest yet adopted on Garratt locomotives.

Getting Results from Foremen's Conferences

Second of a Series of Articles on Foremen's Conferences that are Now Successfully Held in Many of the Leading Industrial Plants Throughout the Country

IN the article in May MACHINERY, page 659, the objects to be attained through foremen's conferences were outlined and the general methods briefly touched upon. The present article will point out, in greater detail, some of the specific requirements for successful conferences and the means by which the best results are obtained.

One of the most important factors is the selection of the right man to lead and guide the conferences and discussions. The success or failure of the plan depends largely upon the characteristics of the leader. He must be somewhat of the executive type, and yet it is preferable for him not to be one of the chief executives of the company. He must, however, be able to command the respect of the group without resorting to any authority vested in him. He must have a clear grasp of the general management problems to be discussed, a good deal of patience and common sense, and must be a good listener rather than an accomplished speaker. He should be mainly a capable referee of the discussions, displaying much interest, but having little to say. It is highly important that he avoid posing as a teacher or professor—he should be a leader in the true sense of the word.

Successful Foremen's Conferences are Informal in their Staging but Definite in their Purpose

Selecting the Time for Foremen's Conferences

Foremen's conferences, as now successfully held, are conducted (1) entirely on the company's time during the working day; (2) partly on the company's time and partly after working hours, the conferences beginning late in the afternoon; or (3) entirely after working hours, generally on some evening during the week. It is the opinion of those who have had the most experience in this work, however, that the best results are obtained when the conferences are held during working hours, because then regular attendance can be made obligatory, and everyone participating will derive greater benefit. Furthermore, the men feel under obligation to give their best when they recognize that the conference is part of their regular work.

Proper Room and Equipment Must be Provided

The success of foremen's conferences is largely dependent upon the room and equipment in which they are held. The room selected should be comfortable, properly heated, well lighted and ventilated, and provided with comfortable chairs. You cannot get the best mental activity out of men who are physically uncomfortable. As the groups are small, arranging the chairs in a semicircular fashion, rather than in schoolroom fashion, will add to the informal character of the meeting. A good blackboard should be provided, and also adequate table space for demonstration material.

Planning the Conference

It is of great importance that the leader take time to plan the work of the conference carefully.

Two mistakes can be made in doing this. It may be planned in too much detail, producing a stereotyped plan which prevents spontaneity and free discussion on the part of the participants. In that case, the leader assumes the role of an instructor, and may put on the blackboard an outline of the plan that he has developed. This gives the foremen the idea that the thing has all been laid out in advance and that there is nothing for them to do but to listen to the leader.

The other extreme is when a leader starts a conference without any other plan than the subject to be discussed. This is likely to lead to a desultory discussion and a great deal of talk without any results. The leader should have definitely in mind the object of the discussion, and should plan to so guide the conference as to bring out the ideas of the different men on the solution of the problem presented. In other words, the leader should have a definite plan for obtaining a solution, while leaving the solution itself to the men whose experience and training can best supply it.

In planning a conference, therefore, the first thing is to determine upon some problem, question, or production difficulty on which it would be of value to the foremen to exchange opinions. This subject should be set up clearly for discussion. The topic should be announced to the participants in advance, preferably at the end of the last preceding conference, so that they will have plenty of time to think it over and prepare suggestions.

The second important thing in planning a conference is for the leader to define in his own mind the object to be attained. For example, in bringing up a certain production difficulty, is his main object to obtain the cooperation of the foremen in the different departments? If so, he should guide the discussion along such lines as would emphasize the value of cooperative effort. Again, if he aims to obtain information that would make it possible to formulate a certain procedure, he should try to so guide the discussion as to bring out and put on record in a systematic way, the best ideas on the subject. If there is no objective, foremen's conferences are largely a waste of time. They may be of value in developing the foreman's personality and knowledge of management problems, but they will not aid the management in solving its problems.

Another important thing for the leader to realize is that the discussion should be stopped after a definite objective has been attained. When a certain solution has been offered to a problem, or the various sides of it have been thoroughly discussed, interest will lag if there is merely a rehash of ideas already expressed. Every man should be trained, as far as possible, to express his ideas clearly and concisely in a minimum time, and the entire conference should be conducted on the same principle.

Subjects for Foremen's Conferences

There is an endless number of subjects that may be discussed at foremen's conferences, and many will suggest themselves by the individual problems in any one plant. Below are given a variety of subjects that have been used in the past to advantage. These, in turn, will suggest others to the active conference leader: What are the causes of accidents in our shop? What should a foreman consider as his main responsibilities? How can a foreman stimulate the interest of his men in their work? What are the best methods of training workers? How can we secure and use the suggestions of our men? How can a foreman maintain discipline and give orders that will be obeyed without his appearing to be a "boss"? What are the most important qualifications of a foreman? What are the duties of a foreman as an inspector? What can be done to prevent waste? What can be done to maintain an even flow of production? What are the best methods of keeping equipment in good running order? How can maintenance expense be held down? What is the best method of keeping records and reports? How can the right job be selected for a man? Is it important to provide an attractive place in which to work? What can a foreman gain by careful planning of the work in his department?

It is also of importance in broadening the foreman's outlook on industrial conditions to bring in a number of general industrial and economic subjects. For example, in the United States the average daily wage is $5.60; in England, $2.82; in France, $1.50; and in Italy, $0.96. How are we able to compete in the foreign markets with these low-wage countries? Does machinery throw men out of work and are workingmen worse off because of improved and automatic machinery? How can a small plant compete with a large plant that can afford to use better mass-production equipment? How should a man's earnings be determined? Should output be the only factor to be considered? What about dependability, steadiness on the job, and length of service? What determines the price of a product? How is the fund of money obtained out of which wages are paid? Why is the statement that manual labor produces all wealth fallacious? How does good management make higher wages possible?

Discussions of general economic topics are important in that they give the foreman a correct viewpoint of the relation of industry to the community at large. It makes it possible for him to answer the questions of his men in regard to management, profits, wages, etc., and offset the one-sided information on these subjects supplied by the agitator. It should not be forgotten that there are some true statements made by agitators, and because the men who listen to them realize that some of the statements are true, they believe that all are. It is, therefore, important that correct information be supplied from some other source. Probably no one is in a position to discuss these subjects with the men in the shop to better advantage than a respected and sympathetic foreman. To give correct information, however, he, himself, must be correctly informed.

* * *

The American Association of Engineers, founded fourteen years ago as an organization of professional engineers interested in the social and economical advancement of the engineering profession, has moved its offices from 63 E. Adams St., Chicago, Ill., to the eighth floor of the Willoughby Tower, Michigan Boulevard and Madison St., Chicago, Ill.

Latest Results from Tungsten Carbide Tools*

Directions for the Design and Fabrication of Tools—Results Obtained in Cutting Cast Iron and Alloy Steels—Some Unsuccessful Applications

W. PAUL EDDY, Jr., Assistant Metallurgist, and HENRY J. LONG, Experimental Department, Brown Lipe Chapin Division, General Motors Corporation

THE brittleness of tungsten carbide materials suggests the use of a large—and especially a thick—tip, in relation to the size of the cut to be taken. The factors limiting the tip size may be the cost of the material, the necessity for ample support of the cutting tip by a stronger and tougher material, and the space available for the operation of the whole tool. It is also necessary, in designing a tool, to consider chip space, especially in the case of a multiple-edged tool, in order that there will be no likelihood of the chips becoming packed on the tool face so that chipping of the edge results.

The comparative weakness of this material demands as sharp a cutting angle as possible, to reduce the chip pressure. In order to use a large rake angle, however, without crumbling at the edge, great rigidity is essential. As more rugged machines are built, it will become possible to use steeper cutting angles. The angles depend, of course, on the material being cut, the type of tool used, and the speed, feed, and condition of the machine. As an example, lathe tools for malleable cast iron are used with a front rake of 5 degrees and a side rake of 5 degrees; these angles can probably be increased for steel if there is freedom from vibration in operation.

As heat generated in the tool is relatively unimportant, it is possible to use broader-nosed tools of tungsten carbide than of high-speed steel, thus distributing the cut over a wider area and lengthening the life of the tool.

Cutting Tool Tips to Size is Not an Easy Operation

It is usually impossible to purchase a piece of tungsten carbide alloy of the size required in a tool. Hence, the first problem encountered, if the user wishes to make his own tools, which may be economical if quantities are used, is that of removing from a small bar of the alloy a piece of the desired size and shape. The bar of alloy should be purchased with its application in mind, so that two dimensions of the proposed tip are correct. Then it would appear to be merely necessary to cut off the length desired by means of a thin grinding wheel of the composition recommended for grinding tungsten carbide.

It is not so simple, however. It has not been found possible to cut completely through even a thin piece of this alloy with a grinding wheel; the piece always fractures before the job is finished. By feeding the disk carefully so as not to heat the alloy excessively, and by turning the piece so as to grind into two opposite sides, or perhaps into all four sides, it may be possible to cut away two-thirds of the section before the piece cracks. The discouraging feature is that, even with these deep notches carefully ground, the fracture is no more likely to occur between the notches than anywhere else—with the limitation, of course, that it always starts in one of the notches.

To grind on one side only (one of the broader sides if the section is not square) directly into the piece, until it cracks, is as good as any method. When this is done, the feed of the wheel into the work, within reasonable limits, appears to have little influence on the result. The notching should not be attempted by hand, but should be done on a small surface grinder. The authors have used a 7-inch wheel, not less than 3/8 inch thick, on the circumference of which has been dressed a rim approximately 1/16 inch thick and 1/4 inch wide, with fillets at the shoulders and a rounded edge.

How to Mount Tips in Holders

The next step is mounting the tips in the holders. A firm support is of paramount importance. The tip must fit its seat closely, and should have contact on at least three sides. Blades of multiple-edged tools, such as reamers and facers, may be made of thin flat pieces of the alloy, which should be mounted in slots sawed at angles of 10 to 12 degrees with the direction of motion at the cutting points. This method results in locking the blades against the pressure of the chip.

The brazing may be done by heating the holder and tip in a furnace having an atmosphere of nitrogen or hydrogen, using copper as the brazing material. Good results can also be obtained without such a furnace, by heating in the flame of a blowtorch, provided a brass alloy be substituted for the copper. The strength of a well brazed joint of brass may not be so great as that of an equally good copper joint; but, owing to the fact that the brass flows more freely, a complete filling of the joint can be made much more easily under the blowtorch with brass than with copper.

Grinding Tungsten Carbide Tools

The tip or blade may be ground to its final shape after mounting. A fixed position on a surface grinder is likely to result in a rounding or crumbling of the point; consequently, it is advisable to grind by hand, moving the tool across the side of the wheel. Good results in roughing have been obtained with 60-I to 80-I Crystolon wheels. For finishing, a 100-I Crystolon wheel is satisfactory. The wheel speeds are approximately 3400 revolutions per minute. If the grinding has been properly done, it is seldom necessary to resort to lapping as the finishing operation.

*Abstract of a paper read before the meeting of the American Society of Mechanical Engineers, at Rochester, May 14, 1929.

Using Tungsten Carbide Tools for Cutting Malleable Cast Iron

One of the operations on malleable-iron castings to which these tools are applicable is the breaking down or chamfering of the flanges of differential case castings. The operation is the first performed on the rough casting. One typical case requires a chamfer of about 1/4 inch on a flange 9 inches in diameter. According to the best results obtained prior to the use of tungsten carbide (with a speed of 72 revolutions per minute and a feed of 0.014 inch), the production per grind averaged 200 pieces; by simply replacing the former tool with one of tungsten carbide, the average production jumped to over 7000 pieces per grind.

On the same lathe set-up, the flange is rough-faced. With the tool formerly used, making a cut 1/16 inch deep, and a feed of 0.014 inch, at 170 feet per minute, the tool life was about 150 pieces per grind. Tungsten carbide tools are averaging 700 pieces per grind. The speed of these operations is at present limited by other tools in the set-up, notably a reamer.

The finish-facing of the same flange is performed on another lathe. High-speed steel tools formerly used produced an average of 400 pieces per grind. Tungsten carbide tools operating at a speed of 300 feet per minute, with 0.013 inch feed, average 12,000 pieces per grind. These tools do not give quite as smooth a finish on the work as high-speed steel, but the great advantage of the new tools, aside from increased production, is the elimination of size variation. It was necessary for the operator to readjust the set-up several times during the life of a steel tool; with the tungsten carbide tool, no adjustment is required throughout a day's run, and no difference in size between the first and last piece can be detected.

Another malleable cast iron application is that of line-reaming pinion bores of differential carriers. A double reamer 3 3/8 inches in diameter, each section having six blades, is run on one such job, at 80 revolutions per minute, removing about 0.015 inch with a feed of 0.052 inch. High-speed steel reamers produced an average of about 1500 pieces per grind, and each reamer had a total life of about 6000 pieces. The tungsten carbide reamers average 9500 pieces per grind, and the life of a reamer is approximately 28,500 pieces. In this application, better finish as well as less size variation is obtained with tungsten carbide. The rate of production, furthermore, has been increased approximately 20 per cent, as the high-speed reamers were run at half the speed mentioned, with a little greater feed.

In these applications the use of tungsten carbide tools has progressed beyond the experimental stage. These tools have been definitely adopted as standard on these jobs.

Cutting Alloy Steel with the New Tools

Everyone has been cautious in applying tungsten carbide to the machining of steel. Nevertheless, there is at present one important job on which a saving is being made by its use. Bevel drive gear forgings, usually of 3 1/2 per cent nickel steel, were formerly made with minimum machining allowances of 1/16 inch on the back and 1/16 inch on the face. The initial operation was to take a fairly heavy facing cut from the backs of the forgings on heavy machines with high-speed steel tools. Owing to the powerful chucking required, an occasional forging was distorted so that, when it was removed from the machine after the cut, the back would not be quite flat. This condition caused trouble in subsequent operations.

The present method is to specify 0.070 inch allowance for machining on the face and to merely clean up the forge shop excess of 1/32 to 1/16 inch from the back with a tungsten carbide facing tool, on a lathe. This means that a comparatively thin cut is taken on a surface so abrasive and at a speed so high that a high-speed steel tool will not finish one piece.

The speed of the initial facing cut on a typical forging, which is from 8 1/2 to 10 inches in diameter, is 120 revolutions per minute, or from 267 to 314 feet per minute. The feed is 0.020 inch. A tungsten carbide tool will face 150 to 175 pieces per grind and will have a total life of 3000 to 4000 pieces. It should be mentioned that some difficulty was experienced in obtaining a lathe that would stand up under the high speeds required to make this facing operation economical, and before such a lathe was used, the tungsten carbide tools gave much trouble in chipping due to lack of rigidity.

Some Unsuccessful Applications

It is natural that, in seeking for applications on which tungsten carbide tools will improve the product or lower costs, some failures will occur. In the interests of all concerned, it is fully as important to record operations for which these tools seem to be unadapted as it is to broadcast their successes. The authors have been unable to make a cutting-off tool for automatic screw machines that operates successfully; every tool chips very quickly. They have not been able to make a tungsten carbide tool work satisfactorily on "Mult-Au-Matics"; the large overhang permits sufficient vibration to chip the tool. This alloy has also proved ineffective in rough-turning the outside diameter of the flange of some differential cases of malleable cast iron, owing to the irregularity of depth of cut. They have also had some difficulty in either purchasing or manufacturing multiple-edged facing tools from which the tungsten carbide blades will not pull out during operation.

In conclusion, it is evident that tungsten carbide alloys are to have an important place in the machining of iron and steel. The authors believe that the future of these alloys as factors in efficient manufacturing is in the hands of neither the makers of the tool materials nor the builders of the machines, but the users of machine tools.

* * *

The number of motor vehicles in use abroad is approaching the number registered in the United States at the end of 1919. Today there are 7,285,000 motor vehicles in use outside of the United States; at the end of 1919, there were 7,585,000 registered in the United States.

New Machinery and Shop Equipment

A Monthly Record of New Metal-working Machinery, Tools, and Devices for Increasing Manufacturing Efficiency and Reducing Costs

"LO-SWING" MODEL U AUTOMATIC LATHE

There has recently been developed by the Seneca Falls Machine Co., Seneca Falls, N. Y., a "Lo-swing" model U automatic lathe which is intended to be a companion machine to the larger model R automatic lathe. The latter machine was described in September, 1926, MACHINERY, page 66. The new model U automatic lathe is designed to machine the lighter types of automobile steering knuckles, stem pinions, side gears, and pistons (both aluminum and cast iron) and also to do second-operation work on some larger parts.

When the machine is started, it makes a complete cycle and then stops with the carriage slides returned to the starting positions. A single lever is operated to bring the tailstock center into position and to start the machine in operation. It is necessary, however, to give this lever a distinct separate movement in order to start the machine. This arrangement avoids accidental starting.

When the machine is equipped with an individual motor drive, the motor is mounted in the base. Power may be transmitted either through a belt or a silent chain, and the drive is entirely enclosed. Pick-off gears are provided for changing both speeds and feeds. Ball and roller bearings are furnished for all shafts, including the main spindle, so that the high speeds required by the latest developments in cutting tool materials may be obtained if desired. All cams, gears, and other parts of the mechanism in the head end of the machine are automatically lubricated by means of a force-feed pump which floods all moving parts with oil.

The ways on which the carriage travels on the bed are equipped with hardened and ground steel plates, the same as all other "Lo-swing" lathes. Longitudinal- and cross-feed movements of the front carriage slide, as well as the cross-feed movement of the rear forming and squaring slide, are obtained by means of cams which are hardened and ground.

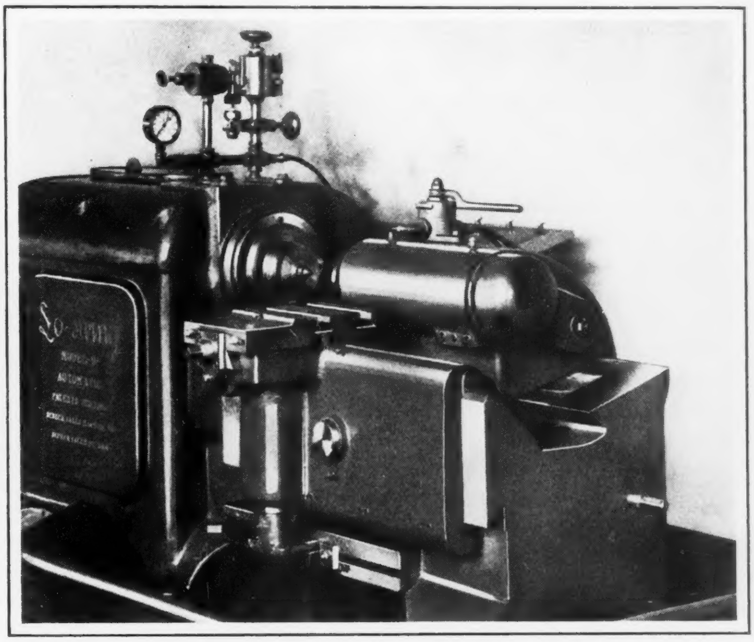


Fig. 2. Close-up of the Front Carriage Slide, Tailstock, etc.

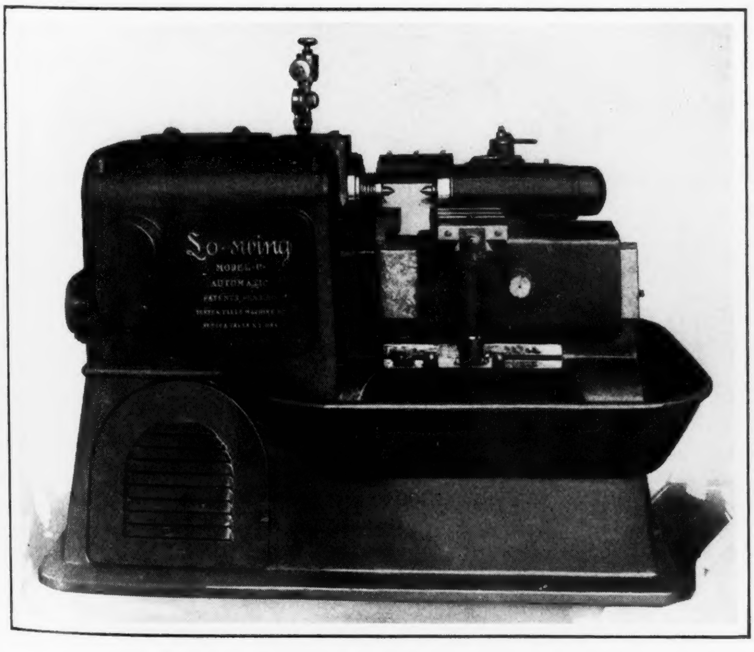
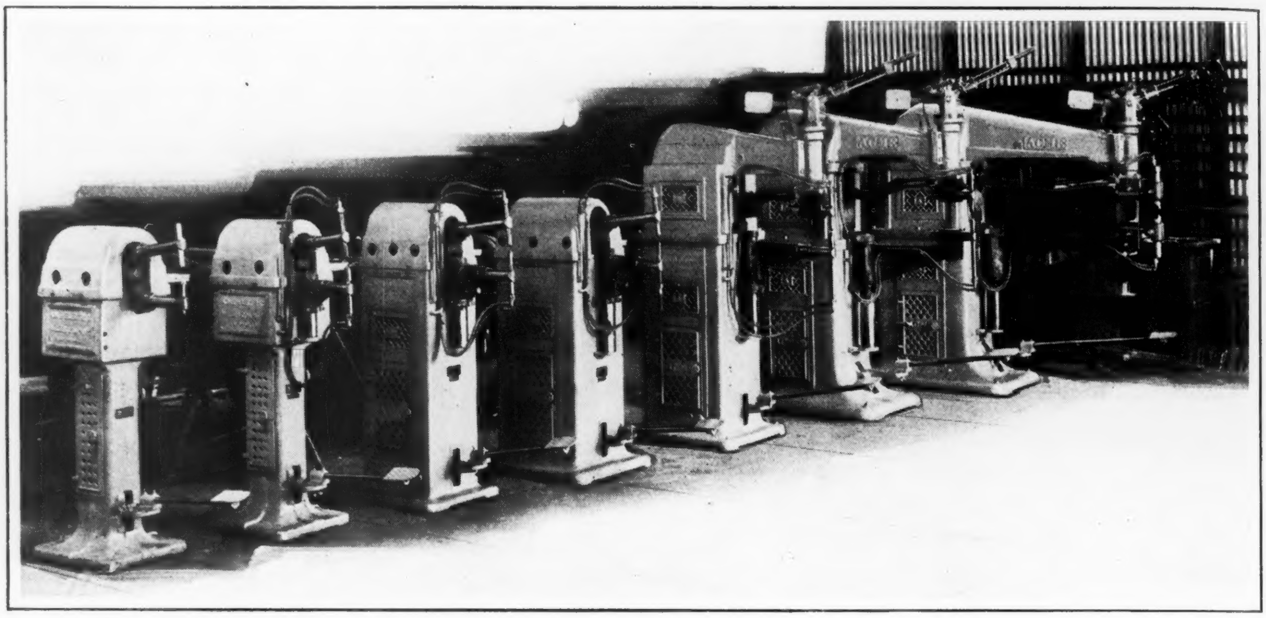


Fig. 1. "Lo-swing" Full-automatic Lathe

The machine will take work up to 5 inches in diameter and 12 inches in length. It weighs approximately 5000 pounds, and is so arranged that automatic loading devices now being developed by the concern may be applied to it.

ACME "HOT SPOT" WELDING MACHINES

Improved spot-welding machines of various types, as illustrated, are being placed on the market by the Acme Electric Welder Co., 5621A Pacific Blvd., Los Angeles, Cal. Intermediate types can be built for special purposes. The machines of this line have a capacity ranging from 7 1/2 to 100 kilowatts, based on the output at the electrode. The transformers are designed to withstand an overload of 100 per cent of the rated welding capacity. In the larger welders, there is a special provision for keeping the transformer cool.



Line of Improved Spot-welding Machines Built by the Acme Electric Welder Co.

Another feature of the machine is a hand contact switch having an easy thumb pressure make-and-break contact which reduces arcing to a minimum and lessens the strain on the operator's hand. A heavy toggle-type 360-degree bonnet swivel head gives heavy pressure with little effort. The lower swivel can be held in any desired position by means of a clamping device that does not mar the copper column. By imparting a half turn to a screw, the swivel can be moved freely laterally or vertically.

GENERAL ELECTRIC MOTOR SWITCH

A switch designed to take the place of the magnetic switch, motor circuit switch, and enclosed fuses usually required in controlling the operation of a motor is a recent development of the General Electric Co., Schenectady, N. Y. This CR-7006-F-1 switch can be used to control any motor where a general-purpose magnetic switch would be used and where its special features are desirable. It is compact, easily accessible, and readily installed.

The switch is furnished with a holding interlock which permits it to be used with a start-and-stop push-button station. If the voltage fails when such a push-button station is used, the contactor will open and will not close automatically upon the return of the voltage, thus making it necessary to press the start button to restart the motor.

IMPROVED FEATURES OF CINCINNATI "HYPRO" PLANERS

Several interesting improvements recently made in the design of the "Hypro" 96- by 96-inch planers built by the Cincinnati Planer Co., Cincinnati, Ohio, may be seen in Figs. 1 and 2. One of these improvements consists of a harp clamp which has been added to the saddles to eliminate any possible chance of the harps pulling away from the saddles when the slides and tools are extended below the bottom of the rail. A narrow guide has also been added to the saddles to prevent springing.

Electric rail clamps are now furnished, there being a torque motor inside the rail at the back, as shown in Fig. 2, which operates two clamps on the inside. A push-button disengages or engages the power clutch. An interlocking arrangement prevents raising and lowering the rail while clamped.

In addition to the improvements mentioned, the standard tumbler mechanism has been simplified to eliminate all shafts and other details, and is connected direct to the master switch. A parallel drive-box located on the outer side of the right-hand housing, permits the motor to be placed parallel with the direction of table travel, and thus saves the floor space ordinarily occupied by the motor. This drive-box is obtainable for all Cincinnati planers. Its shafts are mounted on ball bearings.

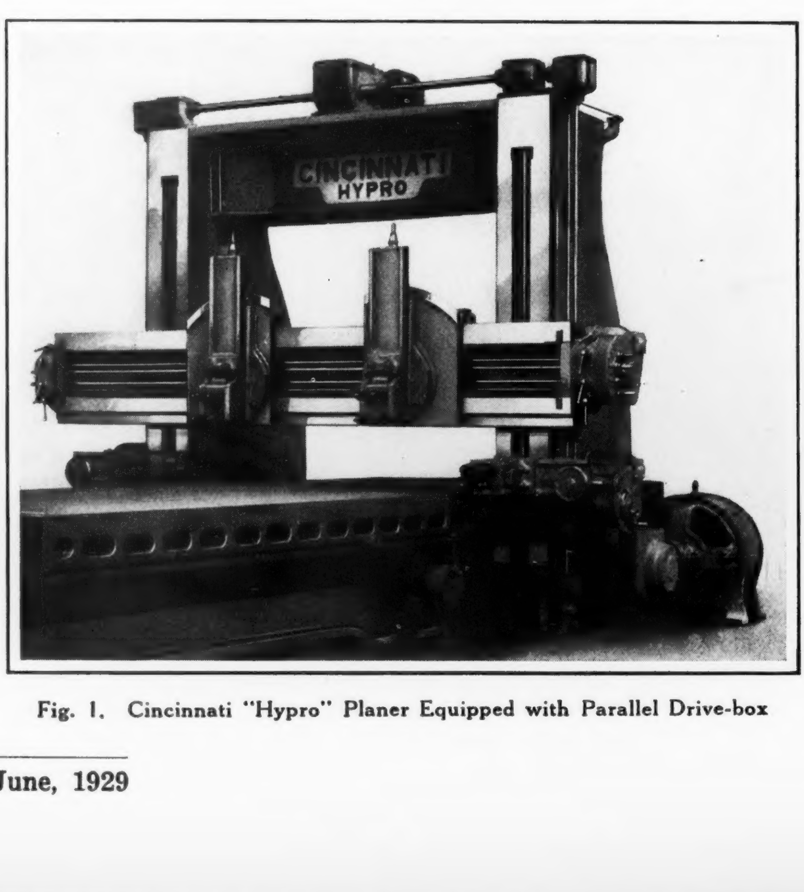


Fig. 1. Cincinnati "Hypro" Planer Equipped with Parallel Drive-box

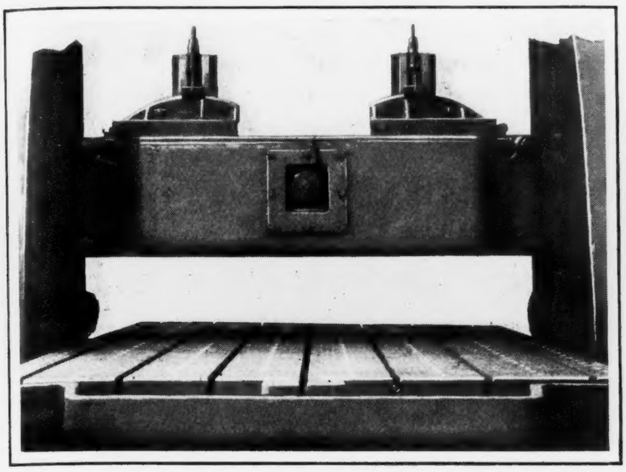


Fig. 2. Location in Back of Rail of Torque Motor which Actuates the Rail Clamps

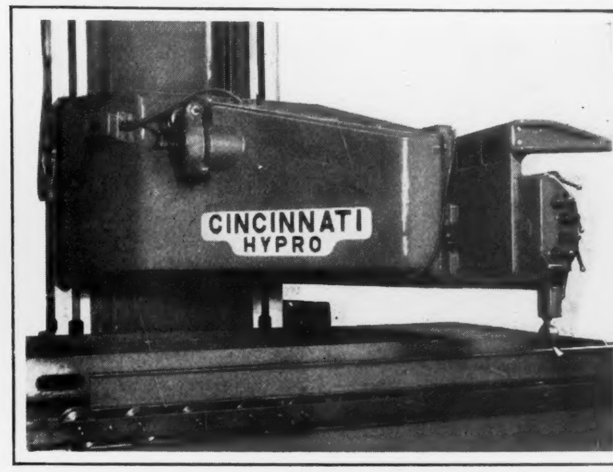


Fig. 3. Supplementary Rolling Table and Torque Motor of Open-side Planer

Figs. 3 and 4 show an open-side planer especially designed for machining safe doors and frames. The heads of this machine are equipped with special, long steel slides which enable them to reach 40 inches below the bottom of the roll. Two means are provided for holding the tools. One consists of the regular clapper-box and tool-block, and the other, of a bar in which the tool is mounted, and which is carried in a hole in the bottom of the slide. The latter method is particularly handy in machining the inside of frames.

The planer is equipped with a special rail having a third way which supports the top of the saddles. The saddles ride on this third way on roller bearings. A narrow guide provided on the saddles eliminates all twisting moments. A self-contained counterbalance takes care of the additional weight of the long slides.

The standard feed and rapid traverse are provided for the heads. Hand feed is obtainable through a square shaft at the top of the slides by means of which the operator can adjust the tools. The harps which carry the slides are bolted to T-slots at the top of the saddles, which arrangement assists the operator in swiveling the heads. Swiveling of the heads is accomplished by employing a crank-handle to turn a pinion which engages with rack teeth cut in the harps.

A supplementary rolling table, which may be seen in Fig. 3, is supplied, so that in machining doors up to 10 feet square, the overhang of the work may be supported. This illustration also shows the electric rail-clamping torque motor provided. Push-buttons for operating the motor are supplied on both sides of the planer. There is also a safety device on this machine, which makes it impossible for the operator to raise or lower the rail while it is clamped.

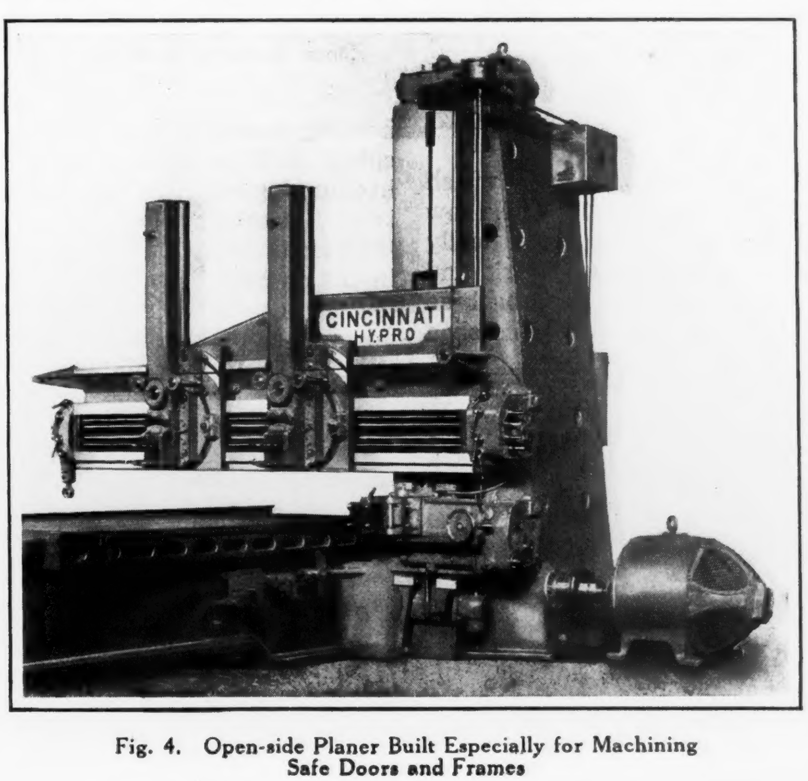
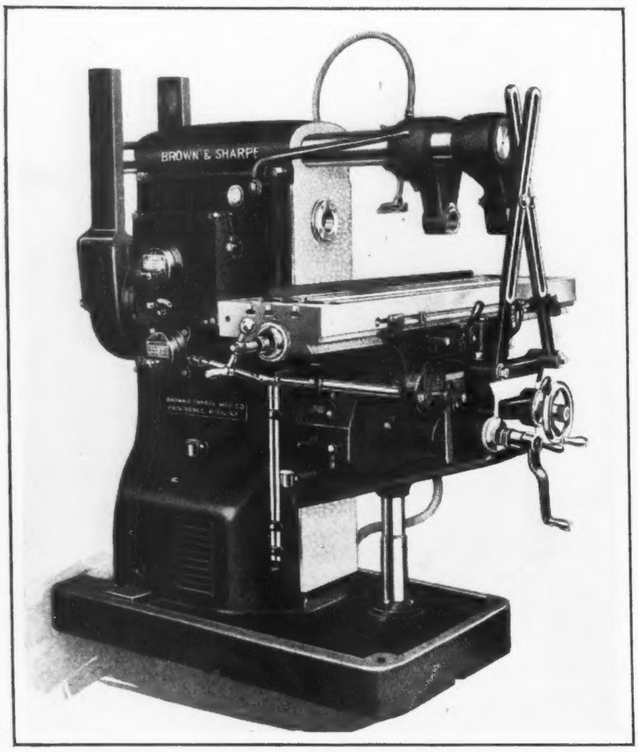


Fig. 4. Open-side Planer Built Especially for Machining Safe Doors and Frames

BROWN & SHARPE LARGE "STANDARD" MILLING MACHINES

Two more machines, the No. 4A universal and the No. 4B plain, have been added to the line of "Standard" milling machines built by the Brown & Sharpe Mfg. Co., Providence, R. I. These machines are the largest of the line. They embody the same construction and operating features as the "Standard" milling machines previously described in MACHINERY for February, 1928, page 474; September, 1928, page 69; and May, 1929, page 703.

An important feature of the No. 4B plain machine, which is here illustrated, is the automatic disengagement of the power fast travel and simultaneous engagement of the cutting feed, without any attention on the part of the operator. This saves considerable time, as work can be run quickly to a point close to the cutters before the feed is engaged. It also prevents damage to the work and cutters through accidental jamming of the work. From the time that the fast travel is started until the cut is completed, the operator may be engaged in attending to another machine.



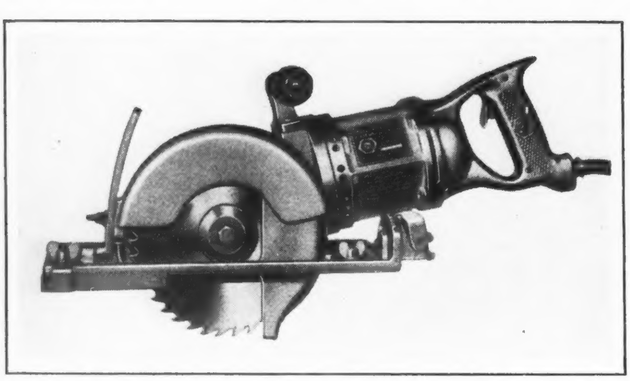
Large Brown & Sharpe "Standard" Milling Machine Made in Plain and Universal Models

The machines are available either with a belt drive, fitted for a motor drive, or equipped with a motor. The motor is located in the ventilated compartment of the base, and drives through a chain and sprockets. The tension of the driving chain is adjustable by means of a screw located outside of the motor compartment.

BLACK & DECKER ELECTRIC HAND SAWS

Three sizes of electric hand saws having circular saws 6, 8, and 10 inches in diameter, have recently been brought out by the Black & Decker Mfg. Co., Towson, Md. These saws will cross-cut and rip lumber up to 3 1/2 inches thick, and may be equipped with a special saw for cutting light gage metal or with an abrasive disk for cutting slate, marble, etc.

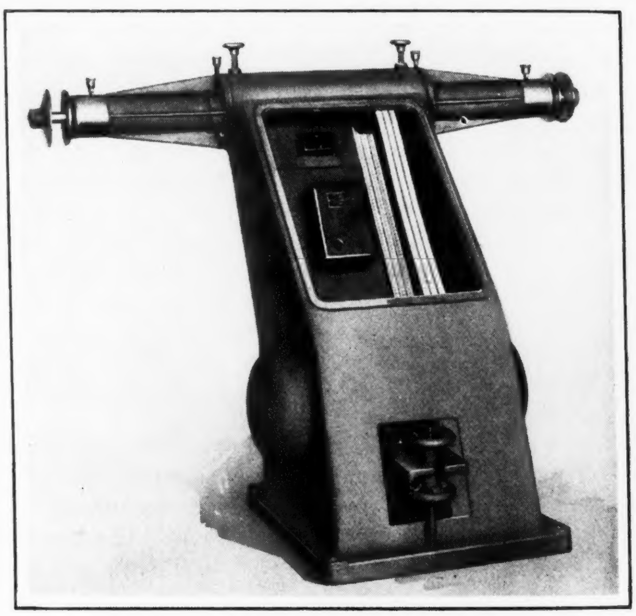
Each saw is driven by a universal motor which operates on direct or alternating current. The saw blade is enclosed within a guard that automatically telescopes as the saw progresses into the work, and when the cut is finished, the guard snaps back so as to entirely cover the saw. An adjustable shoe can be set for cutting rabbets, etc., to any depth. The shoe is also adjustable for cutting at any angle up to 45 degrees for mitering or for jointing long edges. The saws are provided with a pistol grip and trigger switch. They are equipped with ball bearings, and are air-cooled.



Black & Decker Electric Hand Saw

STANDARD BUFFING AND POLISHING LATHES

Buffing and polishing lathes with motor-in-base drives of the type illustrated are being placed on the market by the Standard Electrical Tool Co., 1938-46 W. 8th St., Cincinnati, Ohio, in four sizes of 3, 5, 7 1/2, and 10 horsepower rating. The motor of each machine is of ball-bearing design and drives the buffing spindle through Dayton "Cog Belts." The motor is mounted on a hinged bedplate which can be adjusted to regulate the tension on the belts. Four S K F ball bearings mounted in dustproof housings are provided on the machine. The buffing spindle is fitted with a shaft-locking device for use in changing wheels. The housing of these machines is of the overhanging type and especially adapts the machines for buffing and polishing long pieces in cases where the wheel projects beyond the housing. Speeds of from 2000 to 3000 revolutions per minute are obtainable by merely providing motor pulleys of different diameters.



Motor Drive on Buffing Lathes Built by the Standard Electrical Tool Co.

GENERAL ELECTRIC MELTING POT FOR LOW MELTING POINT ALLOYS

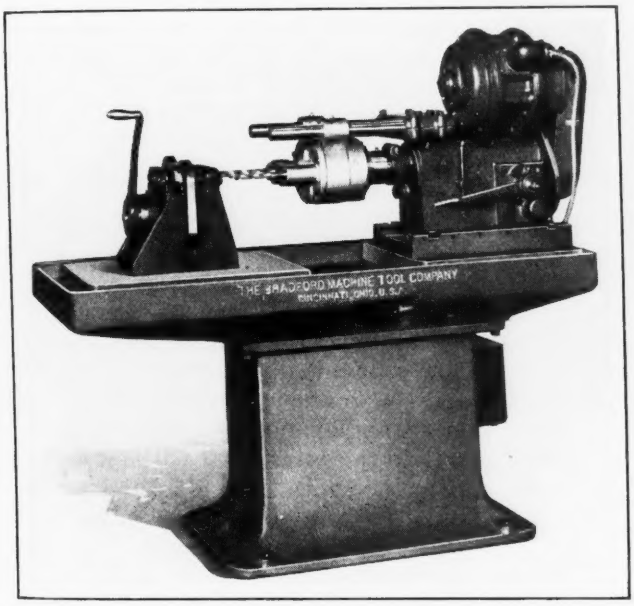
An electric metal melting pot with a bottom pouring spout has been brought out by the General Electric Co., Schenectady, N. Y. It is especially suitable for casting babbitt bearings in railway shops and automotive factories. The new pot is known as the "type RP, form F." The bottom pouring feature is particularly useful when it is impracticable to ladle and when large quantities of

metal are handled. Lead, babbitt, tin, solder, type metal, and similar alloys, except spelter or zinc, may be melted at temperatures not exceeding 950 degrees F. An automatic temperature control is provided.

BRADFORD GENERAL-PURPOSE AUTOMATIC DRILLING MACHINE

The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio, has recently developed a general-purpose automatic drilling machine consisting of one of the single automatic drilling and tapping head units made by the concern, mounted horizontally on a bed as illustrated. The spindle of the unit is so arranged that various types of auxiliary multiple-spindle drilling attachments can be mounted on it.

The particular set-up shown is used in an automobile plant to ream four 5/8-inch holes 1 15/16 inches long simultaneously in cast-iron valve-lifter guide brackets. The cam is arranged to give a rapid approach 3 inches long, a feed 2 1/4 inches long, at the rate of 0.018 inch per spindle revolution, and a rapid return 5 1/4 inches long. The spindle speed is about 470 revolutions per minute. About 1/64 inch of stock is removed in reaming the holes. The floor-to-floor time of the operation is 36 seconds, one man attending to two machines.

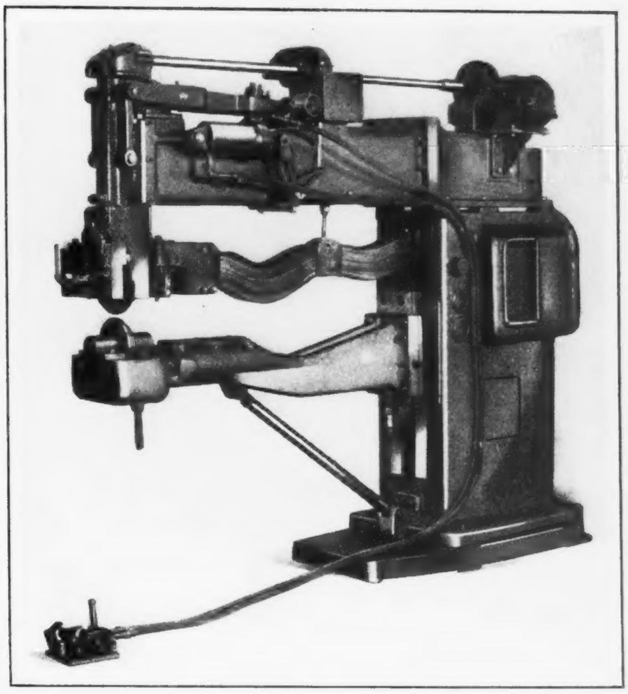


Bradford General-purpose Automatic Drilling Machine

THOMSON SEAM-WELDER FOR CONTAINERS OR WIDE STRIPS

A seam-welder with a throat depth of 48 inches has been brought out by the Thomson Electric Welding Co., Lynn, Mass., primarily for welding containers or flat sheets together to make continuous wide strips. The machine is rated at 175 kilovolt amperes, and is air-operated with an automatic current control.

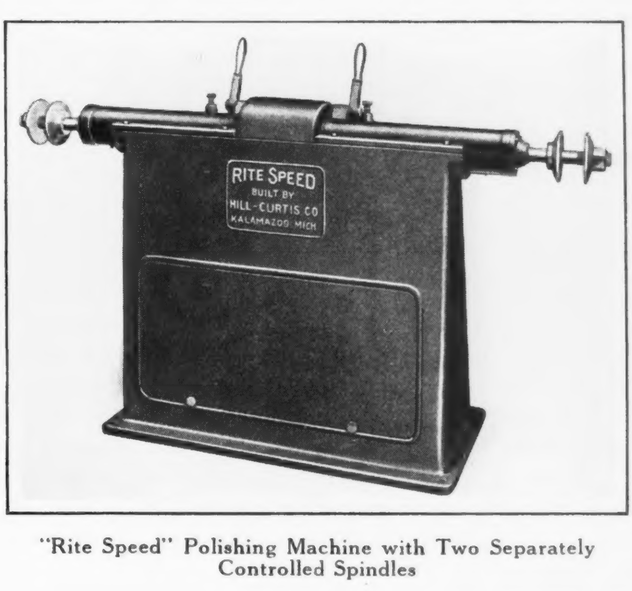
The roller dies and terminal blocks have been made unusually heavy to withstand the severe service that a seam-welder receives. The upper roller or electrode is driven by a motor through a gear reduction unit and spur gearing, while the lower roller is an idler. Both the upper and lower rolls are of large diameter and are water-cooled to insure long life. They may be quickly removed and replaced when necessary. The entire lower roll unit may be replaced quickly by a unit of different design.


Thomson Seam-welder with Throat Depth of 48 Inches

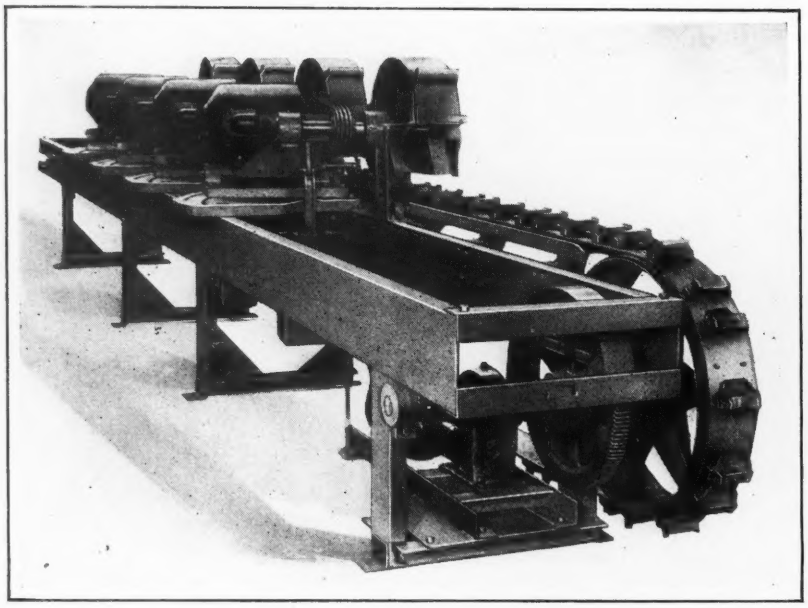
All parts of the machine are designed for heavy-duty operation twenty-four hours a day if necessary. The net weight of the machine is approximately 6500 pounds.

"RITE SPEED" TWO-SPINDLE ELECTRIC POLISHING MACHINE

Two entirely independent spindles driven by separate motors in the base are provided on a "Rite Speed" polishing and buffing lathe now being introduced on the market by the Hill-Curtis Co., Kalamazoo, Mich. In other respects, the machine



"Rite Speed" Polishing Machine with Two Separately Controlled Spindles



Kent-Owens Continuous-type Grinding, Buffing, and Polishing Machine

is similar to the single-spindle buffing and polishing lathe built by this concern.

Power is transmitted to the spindles by means of multiple V-belts. Each motor and spindle can be started and stopped independently of the other, as the two units are controlled by separate starting switches and brakes. The Hill-Curtis combination switches and brakes eliminate the possibility of applying the brake before cutting off the current. By one push forward on the lever, the brake is released and the motor started. In reversing this action, the current is cut off and the brake applied.

The spindles can be operated at different speeds, and by providing different motor pulleys, speeds can be readily changed. Tapered roller bearings or ball bearings can be supplied. The machine is made in 3, 5, and 7 1/2 horsepower capacities for operating on alternating or direct current.

KENT-OWENS CONTINUOUS-TYPE GRINDING, BUFFING AND POLISHING MACHINE

Any number of heads can be provided on a continuous type of machine recently developed by the Kent-Owens Machine Co., 958 Wall St., Toledo, Ohio, for automatically grinding, buffing, or polishing automobile bumper rails, running-board strips, flat iron bases, hardware, small tools, and many other parts. The illustration shows a four-head machine.

Each wheel has an individual motor drive through a flexible V-belt. The pressure of the wheels can be adjusted from 0 to 200 pounds and over, while the machine is in operation, by means of hand-levers located at the front. Another important feature is that the wheels may be set at any angle up to 10 degrees to the right or left of the line of work travel. By staggering successive wheels, the finish of the work is considerably improved.

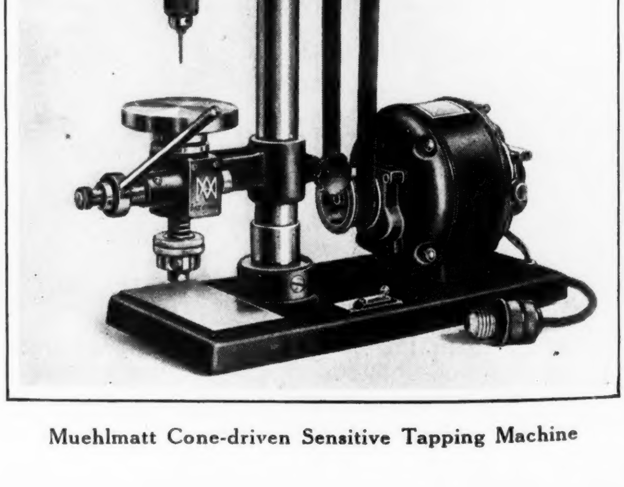
The work-carrying belt is steel-faced and rides upon roller-bearing supports beneath the wheel contact area. Belt stretch is practically eliminated by this feature, and a large flat area is available upon which a wide variety of work can be handled.

The wheel-spindles are mounted in ball bearings encased in dustproof housings. On machines having two or more heads, half the spindles may be operated at the proper speed for new wheels and the other half at the speed required for worn wheels. Thus, as wheels become worn, the proper surface speed can be maintained by simply shifting these wheels to the higher speed spindles.

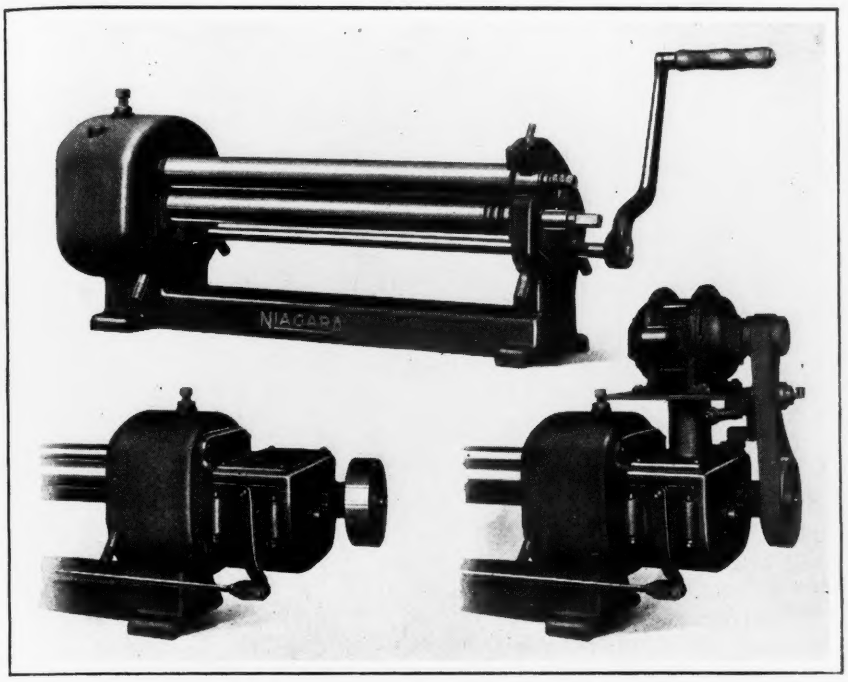
Some of the principal specifications of the equipment are as follows: Width of conveyor belt, 7 or 10 inches; speed of conveyor belt, from 17 to 45 feet per minute; maximum diameter of wheels, 16 inches; over-all width with 7- and 10-inch wide conveyor belts, 49 and 52 inches, respectively; over-all length of four-, six-, and ten-wheel machines, 17 feet 5 inches, 23 feet 9 inches, and 36 feet 5 inches.

MUEHLMATT SENSITIVE TAPPING MACHINE

Holes up to 3/16 inch in diameter, right- or left-hand, blind or through, may be tapped with a sensitive tapping machine placed on the market by Adolph Muehlmatt, Southeast Corner 5th and Elm Sts., Cincinnati, Ohio. In operating this machine, the work is first brought approximately into position for the tap to enter the hole to be tapped. Then, with the tapping spindle running counterclockwise, the tap is permitted to center itself without cutting. When the cutting pressure is applied, the spindle reverses instantly and automatically. For left-hand tapping, a crossed belt may be employed or the rotation of the motor reversed.



Muehlmatt Cone-driven Sensitive Tapping Machine



Niagara Slip-roll Former which may be Hand- or Power-operated

The method of driving the tapping spindle is clearly shown in the illustration. (A circular hood which completely shields the head mechanism to prevent oil from being slung on the operator was removed in taking the photograph.) The horizontal spindle which carries the cone driver is provided with a double set of thrust ball bearings. Belt tension is regulated through the screw at the top of the column. By means of this screw, a travel of 1 inch may be imparted to the head.

The 4-inch round table used in tapping work that can be held by hand is supplemented by a rectangular table measuring 8 by 4 1/2 inches which receives jigs for locating and holding work. Either table is mounted on a 3/4-inch rod having rack teeth that mesh with a pinion. The latter is actuated by a universal ratchet, the feed-lever of which may be set to suit the convenience of the operator.

The lower end of the rack rod is equipped with a micrometer stop which permits the threading of blind holes with safety to the tap. The spindle ceases rotating the instant that this stop reaches its abutment, regardless of the pressure applied to the feed-lever. By means of three pulleys, speeds from 1200 to 2500 revolutions per minute are obtainable. The complete machine weighs about 60 pounds.

NIAGARA HAND- OR POWER-OPERATED SLIP-ROLL FORMER

A 3-inch size has been added to the slip-roll formers built by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y., for forming sheet metal into cylindrical shapes. This former is of geared construction and is arranged with the top roll pivoted at the left-hand end. The roll swings forward to permit the removal of finished work, and is locked in the operating position by means of a quick-releasing trigger mechanism. The equipment is built in three lengths of 36, 42, and 48 inches. It can be furnished for hand operation as shown in the top view of the illustration, equipped with a pulley drive as illustrated at the lower left, or provided with a belted motor drive as shown at the lower right.

The mechanism that frees or locks the right-hand bearing of the upper roll is controlled by a small knurled handle or trigger. A full bearing sleeve is furnished on the movable end of this roll. When the roll is swung forward, the sleeve accompanies it so as to protect the bearing surface. Grooves 3/8, 1/2, and 5/8 inch wide at the right-hand end of the back and bottom rolls permit work with outside wired edges to be formed.

All three rolls are positively driven to make possible the rolling of work to small diameters. The gears are always in mesh, whether the upper roll is swung forward or whether the upper and lower rolls are separated for handling folded edges.

A self-contained unit can be readily applied to hand-operated forming rolls for driving by power. This unit has a reversing clutch which permits the rolls to be run forward or backward and to be started or stopped at will. A one-horsepower motor of from 1500 to 1800 revolutions per minute is required to drive the machine.

REED-PRENTICE DIE-SINKING AND VERTICAL MILLING MACHINES

Two die-sinking and vertical milling machines provided with full ball-bearing drives from the

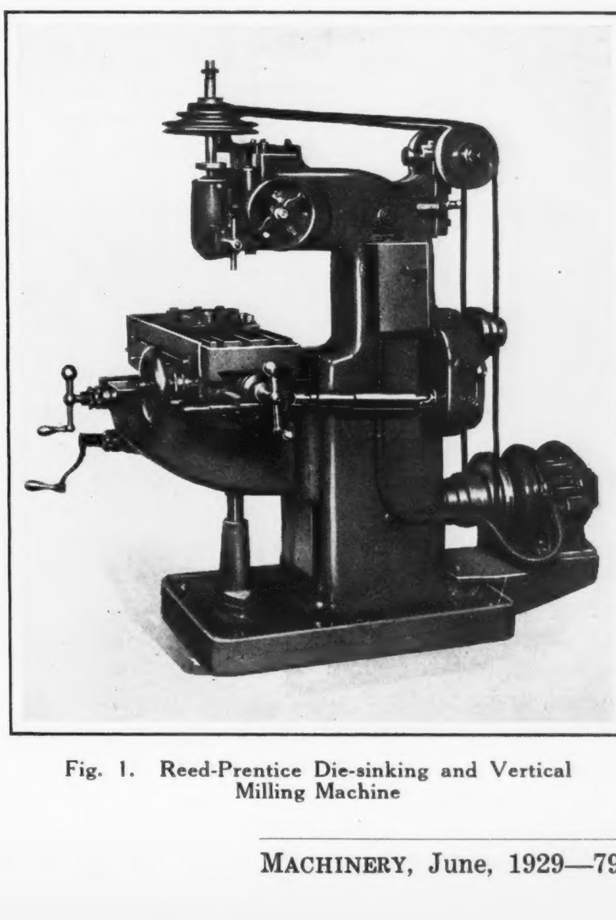


Fig. 1. Reed-Prentice Die-sinking and Vertical Milling Machine

motor to the spindle have recently been added to the line of machine tools built by the Reed-Prentice Corporation, Worcester, Mass. Not only are the spindles on both machines equipped with radial and thrust ball bearings, but the idler and cone pulleys also run on ball bearings. This feature permits spindle speeds up to 4000 revolutions per minute on the No. 3 machine shown in Fig. 1, and up to 6000 revolutions per minute on the No. 2 machine illustrated in Fig. 3. Proper belt tension is obtained by adjusting a movable idler-pulley bracket. Fig. 2 shows the manner in which ball bearings are provided for the spindle of the No. 3 machine.

A longitudinal power table feed is provided on the No. 3 machine through feed cone pulleys and a box having sliding gears, six different feeds being available. A rotary attachment with hand or power feed can be applied at any time. Both the longitudinal- and cross-feed screws are arranged with micrometer dials and ball thrust bearings. The handwheel at the right-hand side of the table at the front permits a slow hand longitudinal feed and also a hand feed to the rotary table by engaging a clutch. The adjustable head which carries the spindle is equipped with a micrometer depth stop.

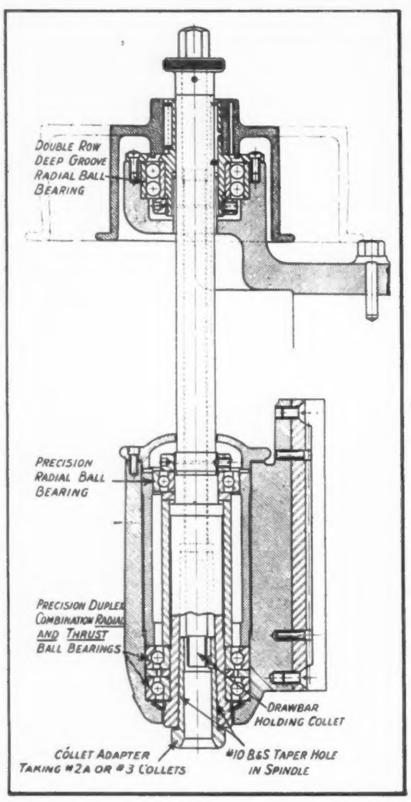


Fig. 2. Spindle Construction of No. 3 Machine

An oil-pump with piping and settling tank located in the base of the column can be furnished. Both the machine and rotary tables are provided with oil troughs that return the lubricant to the tank. A sliding chip guard in front of the carriage protects the cross-feed screw. Without the rotary table, this machine weighs approximately 2400 pounds, and the rotary table weighs 110 pounds.

On the standard No. 2 machine furnished with a cone pulley for a countershaft drive, six spindle feeds are available through the use of two spindle drive pulleys. A flat canvas belt adapted for high speeds is regularly furnished; however, when slow speeds are required or large cutters are used, a leather belt is recommended. The cross, vertical, and longitudinal feed-screws of this machine are also equipped with micrometer collars for accurate control, and all screws are supplied with ball thrust bearings. A micrometer stop permits the head to be accurately fed to depth, the head being operated either by means of a foot-treadle or through a clutch-type handle on the right-hand side of the column. A rotary table can also be furnished for this equipment.

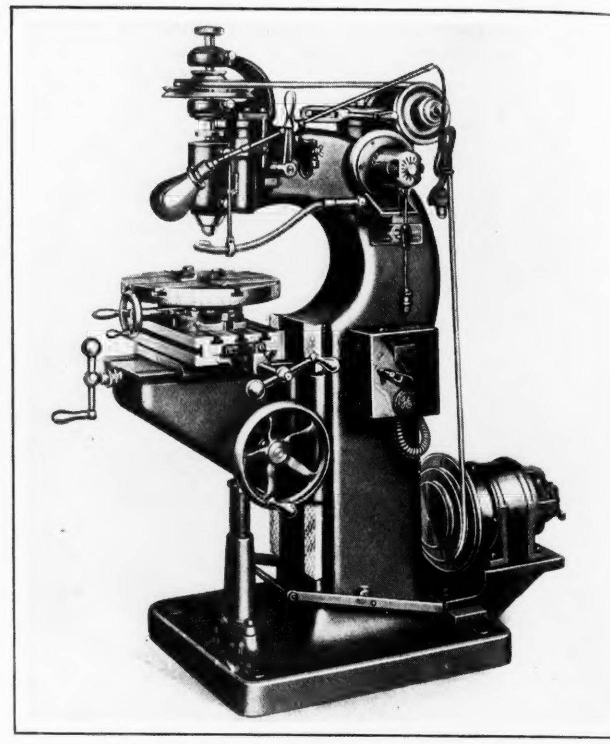
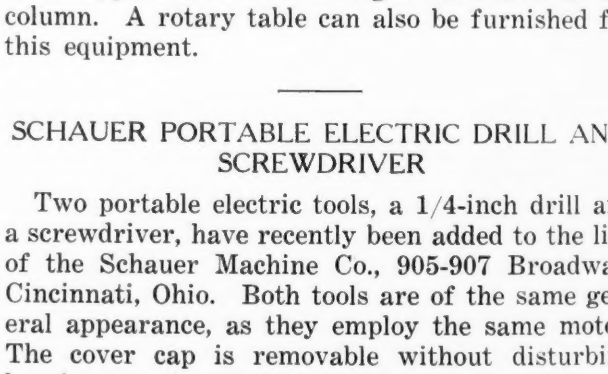


Fig. 3. No. 2 Machine which may be Run at Speeds up to 6000 Revolutions per Minute

SCHAUER PORTABLE ELECTRIC DRILL AND SCREWDRIVER

Two portable electric tools, a 1/4-inch drill and a screwdriver, have recently been added to the line of the Schauer Machine Co., 905-907 Broadway, Cincinnati, Ohio. Both tools are of the same general appearance, as they employ the same motor. The cover cap is removable without disturbing bearings or electrical connections and permits inspection of the motor while running. Both tools are ball-bearing equipped and are of the offset close-corner type. The gears are made of nickel steel and run in grease. The studs are also nickel steel and are supported at the top and bottom.

While the drill is equipped with a Jacobs c[illegible] as illustrated, the screwdriver is provided [illegible] screw-slot finder and finder bit. Howeve[illegible], it can be used without the finder if necessary or with socket bits for tightening nuts. One of the main features is the absence of exposed moving parts that would mar the work in case of slippage or in



Schauer Quarter-inch Electric Drill

close-corner operation. The positive clutch and thrust bearings are located in the gear head. This feature allows the use of a large-diameter clutch and provides for positive lubrication.

NEWARK IMPROVED CUTTER SHARPENING MACHINE

An improved machine for sharpening formed tooth cutters and gashing cutters has recently been developed by the Newark Gear Cutting Machine Co., 69 Prospect St., Newark, N. J. This No. 0 machine sharpens cutters from the smallest size up to 10 inches in diameter. It employs practically the same principle as the previous design.

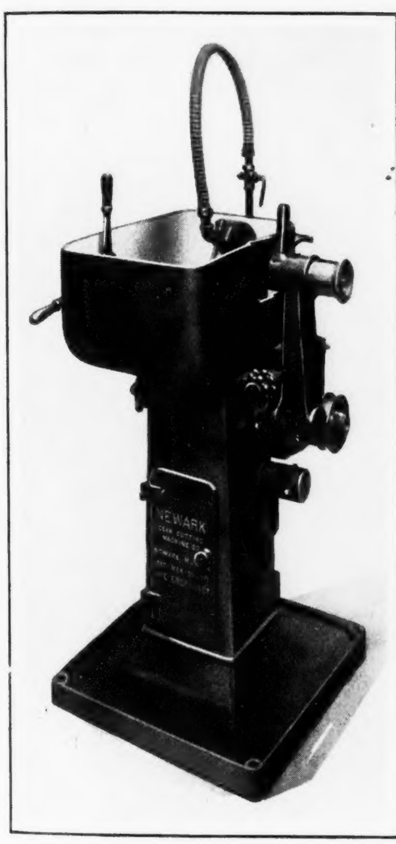


Fig. 1. Newark Cutter Sharpening Machine

One of the main improvements lies in the construction of the wheel-spindle. This spindle is now equipped with Timken tapered roller bearings, and is made of a high-carbon steel. It is carried on a heavy lever that is pivoted about half way down the base. The operator grasps this handle above the spindle with his right hand to pass the wheel back and forth across the cutter teeth. Inward travel of the wheel is governed by an adjustable stop. The wheel-spindle is driven by belt at [illegible]d of 2800 revolutions per minute. An adjustable guard surrounds the wheel. Coolant is fed to the wheel through a flexible hose by a pump within a tank attached to the column at the rear.

As may be seen in Fig. 2, the cutter to be sharpened is located on a central stud of a table, adapter bushings being provided to suit cutter holes of different diameters. The face of the wheel which does the grinding is adjusted in relation to the center of the cutter by means of a gage. The machine may be quickly set to grind radial teeth or under-cut teeth of any hook angle. In sharpening cutters of the latter type, it is often impossible to grind the entire cutting face of the teeth at one setting, due to a central web. In such cases, the cutter holding table is tilted on both sides of the horizontal to permit grinding the complete cutting edge. Heavy-pitch cutters can be sharpened without turning the cutter over or changing grinding wheels.

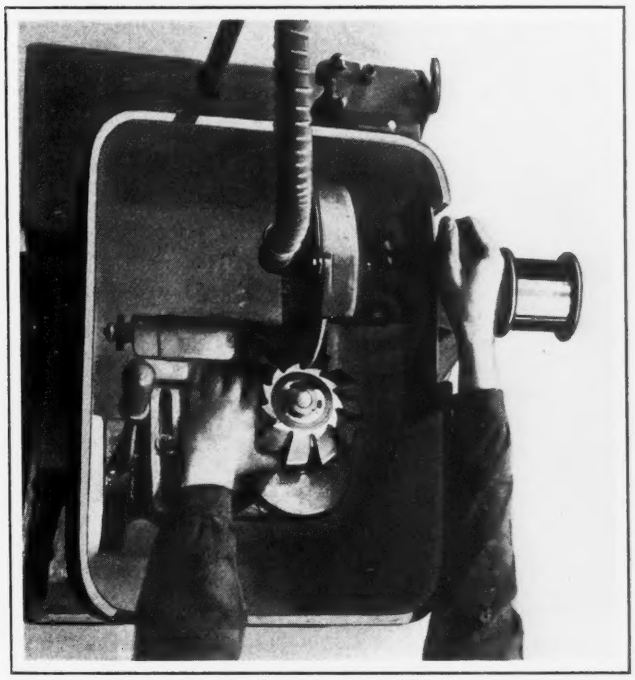


Fig. 2. Top View of the Newark Cutter Sharpening Machine

The cutter is indexed from tooth to tooth by the left hand of the operator, who locates it by means of a spring pawl that rests against the back of the tooth being ground. This method insures equal grinding of each tooth, regardless of errors in cutter or dial spacing. The indexing finger is equipped with a screw feed adjustment which brings more of the cutter into contact with the wheel as the sharpening proceeds. The device keeps the edges of the cutter always radial or at the same hook angle, as desired.

The machine is equipped with a diamond and truing device. It weighs about 925 pounds.

WEDGE-LOCK MULTIPLE-BIT TOOL-HOLDER

Various sizes of tool bits can be conveniently used in a multiple-bit holder recently patented and placed on the market by the Wedge-Lock Tool Co., 549 W. Randolph St., Chicago, Ill., as long as the total width or height measurement of the bits equals that of the tool slot. This tool-holder is made in right- and left-hand offset types. Two kinds of tool slots are available, a square slot in sizes of 1/4 inch and up, and a rectangular slot in sizes of 1/4 by 1/2 inch and up.

Tool bits are secured in this holder by a wedge-locking device in which one wedge is used for hold-

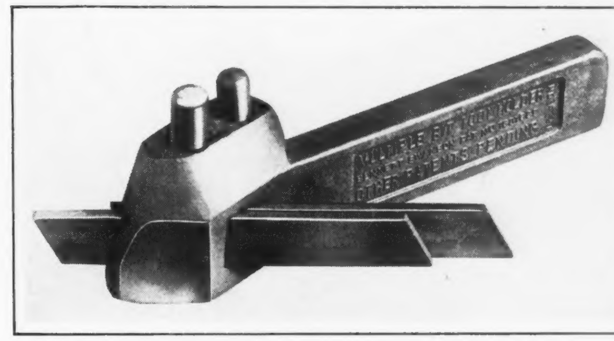


Fig. 1. Wedge-lock Tool-holder which Takes Bits of Various Sizes

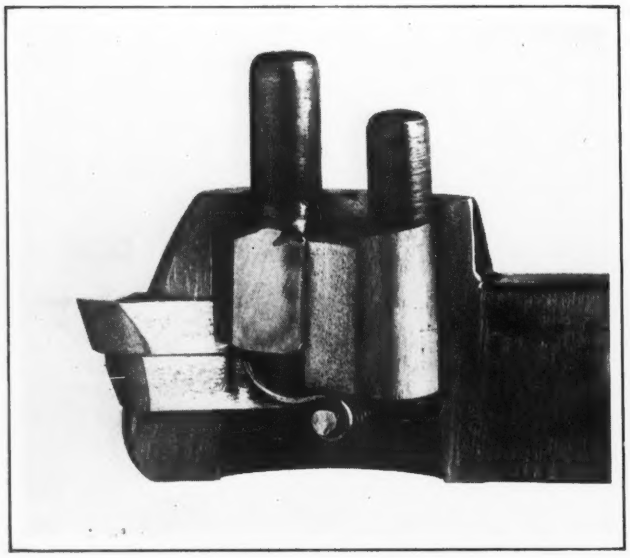


Fig. 2. Arrangement of Two Wedges which Lock and Release the Bits

ing and a reverse wedge for releasing. From Fig. 2, which shows the holder cut away to expose the locking mechanism, it will be seen that two round pins extend from the top of the holder. To lock a tool bit in place, it is merely necessary to impart a light tap to the forward pin. This drives down a wedge that comes in contact with one side of the tool bit and locks it in place in the opening of the holder. The angle of the wedge is such that it takes care of variations in the tool bits.

To release the bits, the other pin is struck a light tap. This pin has a wedge tapered in the opposite direction to the first wedge, and as it is lowered it releases the pressure on a parallel block between the two wedges with the result that the locking pin is released and frees the bits.

One of the particular advantages of this tool-holder is the fact that narrow bits of high-speed steel may be used, as shown in Fig. 1, together with a filler piece. In addition to the saving in tool cost, this feature eliminates the large amount of grinding often necessary on tool bits when they must have narrow cutting points. Another advantage of the multiple-bit principle is found in the use of Stellite, Carboloy, Widia, etc., as the additional bit used under the cutting bit in such cases gives the latter support to withstand the heavy downward strains.

When it is necessary to change bits, this may be done without backing away the compound rest to withdraw the tool from the work, by merely sliding out the bit from the back of the holder. This feature saves time and also avoids the necessity of handling the hot cutting edge of the tool upon the completion of a cut. Rapidity in changing bits is another claim made for the holder.

BOLENDER GEAR BURNISHING MACHINE

Uniformity of the pressure applied to the gears being burnished is one of the principal advantages of the Bolender gear burnishing machine now being placed on the market by the City Machine & Tool Works, 1521 E. Third St., Dayton, Ohio. This uniform pressure is obtained through the use of an air cylinder and valves which control the movement of a member carrying the burnishing rolls. The pressure applied is registered constantly on a dial gage which can be checked at a glance by the operator or foreman.

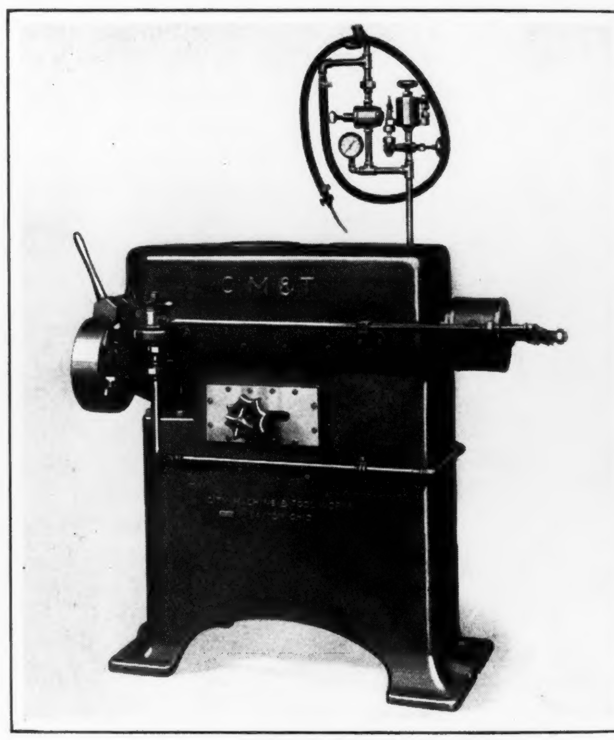


Fig. 2. Bolender Gear Burnishing Machine with Air Control

Gears are burnished with their center line vertical, which insures a straight bearing on gears of any weight or length. Various lengths and diameters of gears are quickly accommodated in the machine by moving the supporting member upward, downward, or sideways. This is done by simply turning the hand-knobs which may be seen at the front of the machine in Fig. 2.

Speed of operation is another feature that is claimed for this burnishing equipment, it being stated that from 2300 to 3000 gears of from 16 to 30 teeth and of 6-8 diametral pitch can be burnished in a nine-hour day.

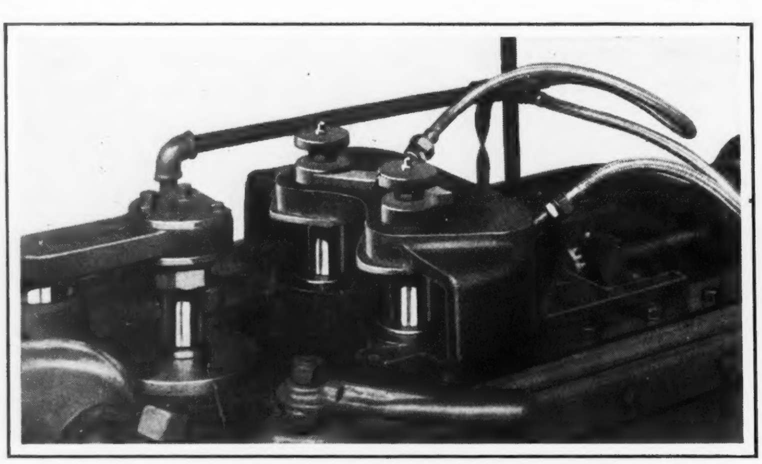
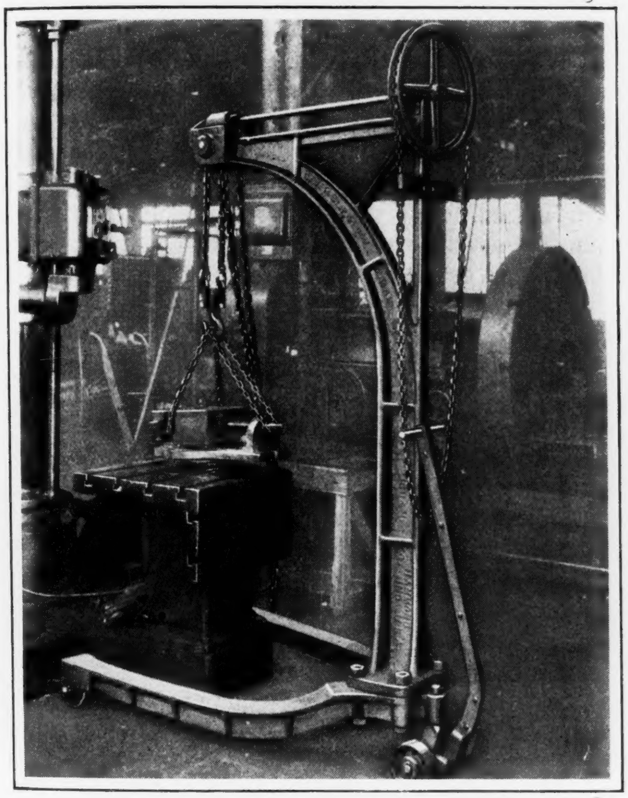


Fig. 1. Close-up View of the Burnishing Roll and Work-spindles on Bolender Gear Burnishing Machine

HAMMOND PORTABLE CRANES

Four Hammond "Never-Slip" portable cranes of the design illustrated are being placed on the market by the Beatty Machine & Mfg. Co., Hammond, Ind. The lifting capacity of the four sizes is 2000, 4000, 5000, and 6000 pounds, while the lifts are 4 feet 10 inches, 5 feet 6 inches, 6 feet 6 inches, and 7 feet 6 inches. A feature of these cranes is the provision of "Never-Slip" worm and screw hoists which automatically lock at all points of travel.

The hoisting gear of each crane consists of a worm-gear, with a sprocket cast integral and a screw cut from solid steel shafting. The crane base and column are steel castings. The axles are made of chrome-nickel steel, and are fitted with Hyatt roller bearings, which make it easy to move the equipment from place to place.

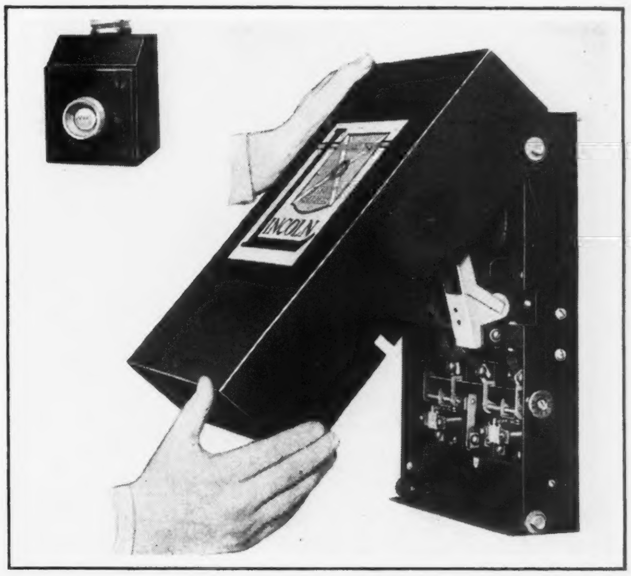


Hammond Portable Crane Made in Lifting Capacities of from 2000 to 6000 Pounds

LINCOLN ACROSS-THE-LINE SAFETY STARTER

An improved starter which starts a motor directly across the line has recently been placed on the market by the Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio. This starter is controlled by the safety push-button described in February MACHINERY, page 468. Installation of the starter is simple, as only four screws are required to hold it in place. Releasing two other screws permits the panel to swing outward, thus making lead contacts easily accessible. A cover of the drop hinged type encloses the entire mechanism and permits the starters to be installed close together, 2 inches of clearance between boxes being ample for accessibility.

Long life of the contact points is assured by a wiping action which prevents pitting, and by cadmium-plated steel shields which provide an instantaneous thermal and magnetic quench for the arcs.



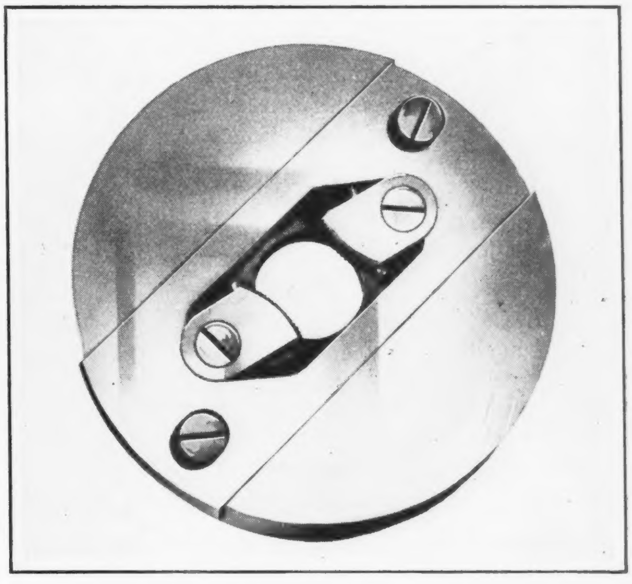
Lincoln Across-the-line Starter with Safety Push-button

The arc chimneys are of heavy pressed magnetite, which shield against currents far higher than any to which the starter will ever be subjected. The safety push-button can be mounted on the side of the starter box or arranged for remote control.

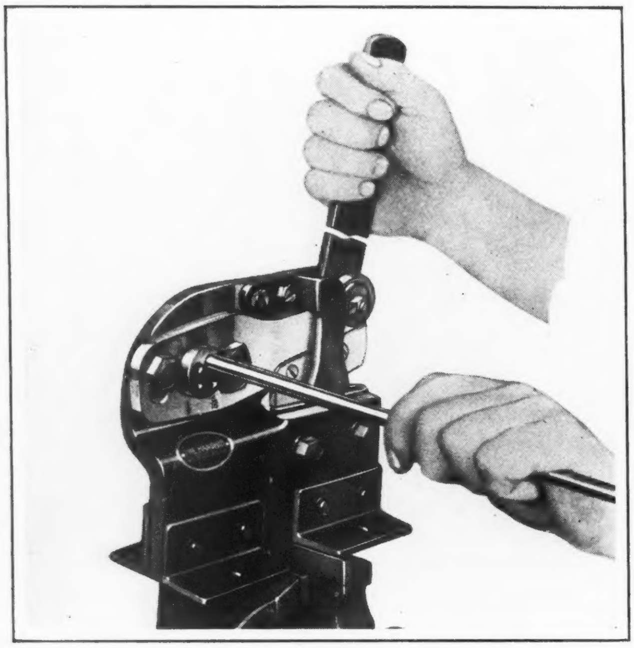
SENECA FALLS AUTOMATIC DRIVER

An automatic work-driver which may be applied to any machine by using a chuck plate similar to that employed with standard lathe chucks is being placed on the market by the Seneca Falls Machine Co., Seneca Falls, N. Y. As will be apparent from the illustration, the work is gripped by two jaws having corrugated surfaces which are eccentric in relation to the pivoting points of the jaws.

The jaws are mounted in a slide which is free to float transversely in the driver head, so that, regardless of whether or not the work is properly centered, there is no danger of exerting an excessive amount of pressure on the center of the headstock. The construction of this driver is fully covered by letters patent.



Seneca Falls Work-driver, Applicable to Various Types of Machines



"Handnib" Designed for Cutting Drill Rod, and for Inside and Outside Nibbling and Shearing

COMBINATION DRILL ROD CUTTER, NIBBLER AND SHEAR

Drill rod cutting, outside nibbling, inside nibbling, and shearing can be done in a model A-5 "Handnib," recently designed by the National Machine Tool Co., Racine, Wis. The principal new feature claimed for this model is the provision for cutting drill rod without distortion. The illustration shows an operation of this kind. Two dies are provided containing four holes to receive drill rod 3/16, 1/4, 5/16 and 3/8 inch in diameter.

Another new feature of the equipment is the provision for inside nibbling. After drilling a hole, metal sheets can be readily nibbled to the desired outlines at any distance up to 3 inches from an outside edge. Nibbling blades are 1/4 inch thick and cut flat stock up to 1/8 inch thick. The equipment can be mounted in a vise or on a bench.

"PRODUCTO" AUTOMATIC CAM MILLING MACHINE

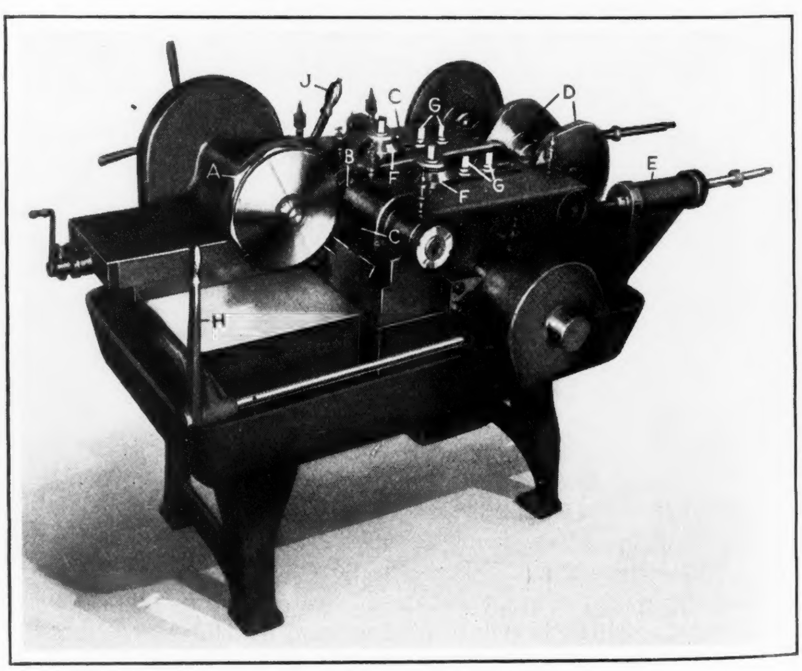
Circular cams of many different styles can be milled in an automatic machine of duplex design recently developed by the Producto Machine Co., Bridgeport, Conn. In the illustration, this machine is shown arranged for milling double-edge cams of the kind used in radial type aviation engines. Two separate cams of different styles can be milled simultaneously by employing the proper master cams for actuating the two cutter-slides, or one cam can be milled by using one cutter-slide only. The cams to be milled are mounted on the work-head, as shown at *A*, and are presented to cutters located at *B*, these cutters being mounted on the spindles of slides *C*.

The machine is equipped with a single pulley drive from which power is transmitted through one set of worm-gearing to a shaft at the rear on which the master cams *D* are mounted, thence through a second set of worm-gearing to the work-spindle and through two sets of spur gearing to the cutter-head spindles. As the master cams *D* revolve, they move the cutter-slides *C* forward and backward so as to mill the work cams to the desired contour. A lever provides for conveniently disengaging the worm of the camshaft worm-wheel when it is desired to reset the master cams. Springs within two housings *E* hold rollers, mounted on rams attached to the cutter-slides, in contact with the master cams.

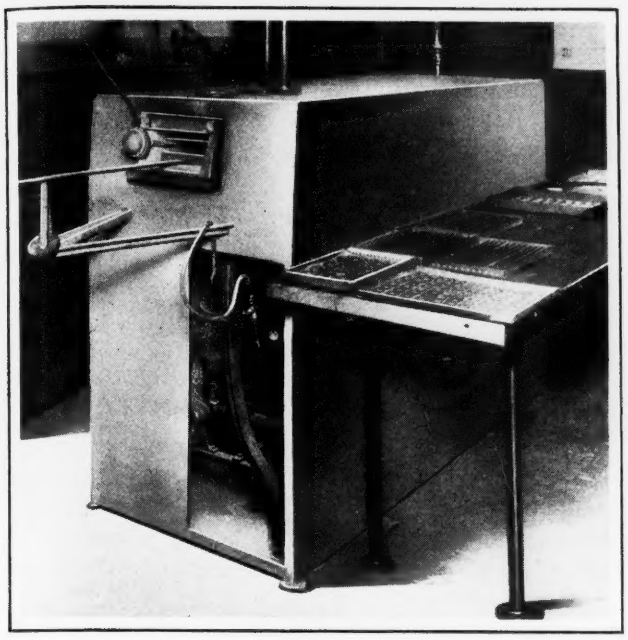
Adjustment of the cutters to suit the size of cams to be milled is accomplished by means of the rams on which are mounted the rollers that engage the master cams. Fine adjustments of these rams are made by turning the dial-equipped micrometer screws *F*, and the rams are locked in desired settings by means of clamp-screws *G*. The cutter-spindles can be equipped with either Timken tapered roller bearings or ball bearings.

For reloading purposes, the work-head is withdrawn toward the front end of the machine by operating the crank-handle on the work-head. A micrometer stop is set to insure accurate positioning of the work-head each time it is returned to the milling position. The capstan wheel on the left-hand side of the work-head is used to operate a draw-back adapter for locking the work cams on the head spindle and for releasing them at the end of the operation. Lever *H*, which operates a clutch, is manipulated to start and stop the machine.

In place of the bed shown, this machine may be provided with a cabinet base and with a motor drive enclosed within the base. In designing the machine, attention was paid to making each part accessible, and to obtaining a rigid construction with a low center of gravity. Cams up to 16 inches in diameter can be produced.



"Producto" Duplex Type Cam Milling Machine



Brandt Furnace Designed Primarily for Annealing and Soldering

BRANDT ANNEALING AND SOLDERING FURNACE

Temperatures up to 2000 degrees F. are obtainable in the furnace here illustrated, which is intended primarily for use in annealing and soldering parts made from brass, bronze, steel, nickel silver, sterling silver, gold, etc. This furnace was developed by the Brandt Engineering Corporation, 71 W. 45th St., New York City, and is being placed on the market by Weisberg & Greenwald, of the same address.

Parts to be annealed or soldered are placed on steel trays which are entered into the furnace at one end and pushed through to the discharge end. The work is protected from oxygen, and oxidizing or scaling does not occur. By passing the work through a cold chamber, cooling of the parts as well as their heating, is under control. In soldering operations no flux is necessary and the solder flows freely.

These furnaces can be built to be heated by gas, oil, or electricity, as desired, and various lengths can be built to meet requirements.

AMERICAN HYDRAULIC BROACHING MACHINES

The two hydraulic machines here illustrated have recently been placed on the market by the American Broach & Machine Co., Ann Arbor, Mich. The V-4 machine, shown in Fig. 1, has a capacity of four tons, while the V-2 machine, illustrated in Fig. 2, is built in two capacities of four and six tons. Both machines are driven by a 5-horsepower motor running at 1200 revolutions per minute. They require an operating floor space of 4 by 5 feet and an over-all operating height of 10 feet.

The two machines are fitted with both foot-treadle and hand-lever controls. Adjustable knock-off stops can be set to give any desired stroke. There is a direct-reading gage on each machine which gives the pressure in pounds and tons. Both machines may be fitted with a balanced piston valve which gives full pressure in either direction. When a slip-stem valve is provided, the V-4 machine is particularly suitable for straightening operations, as any desired pressure from zero to maximum is readily obtained by increasing the pressure on the foot-treadle.

The pumping unit in the two machines is of the internal gear type. On the V-4 machine, the oil tank is cast in jacket form around the cylinder, while on the V-2 machine, the oil reservoir is located in the base and has a capacity of 10 gallons.

The V-4 machine has a maximum clear space of 23 inches between the table and the ram, while the clear space from the front of the tie-rods to the center of the ram is 4 inches. The work-table is 24 inches wide. The bore of this machine is 4 inches. The ram has a downward speed of 18 feet per minute and a return speed of 24 feet per minute. The machine weighs about 3000 pounds.

On the V-2 machine, the maximum space between the table and the ram is 20 inches, and the depth of throat is sufficient to take work up to 15 inches in diameter. The speed of the ram on the down stroke is 20 feet per minute, and the return speed, 24 feet per minute. The bore in the table is 3 inches in diameter, and in the cylinder, 5 inches in diameter. This machine weighs about 4100 pounds.

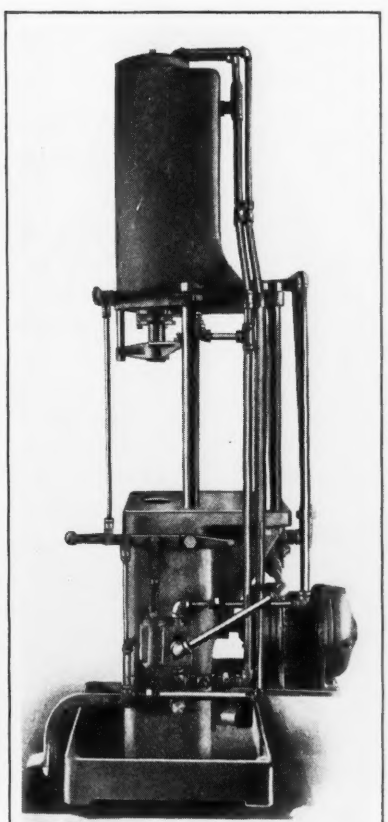


Fig. 1. American V-4 Hydraulic Broaching Machine

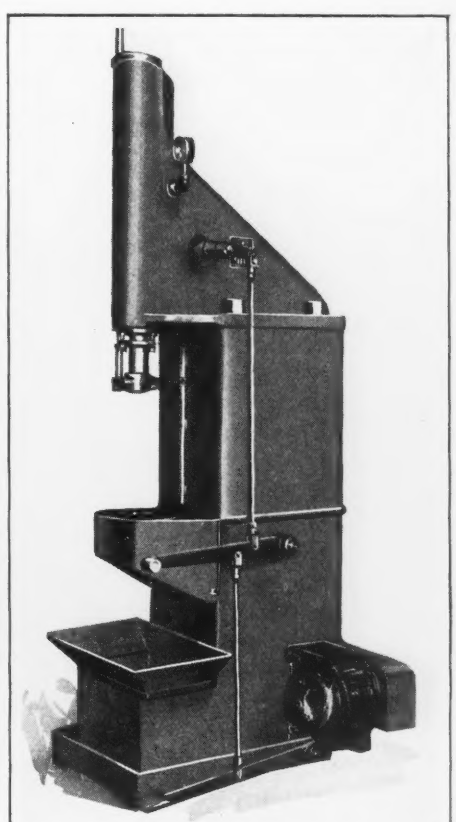
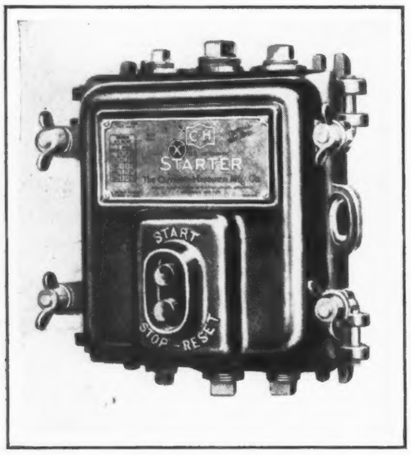


Fig. 2. Type V-2 Hydraulic Broaching Machine

DUST-TIGHT CASES FOR CUTLER-HAMMER MOTOR STARTERS

Dust-tight enclosing cases of two types have recently been designed by Cutler-Hammer, Inc., 1203 St. Paul Ave., Milwaukee, Wis., for the across-the-line automatic starters made by this concern. For motors up to five horsepower, the case is made of cast iron as illustrated, while for larger sizes, it is made of heavy welded boiler plate. These cases are not intended to replace the standard dustproof enclosures, but are rather for use in installations where a large amount of dust exists in the air.

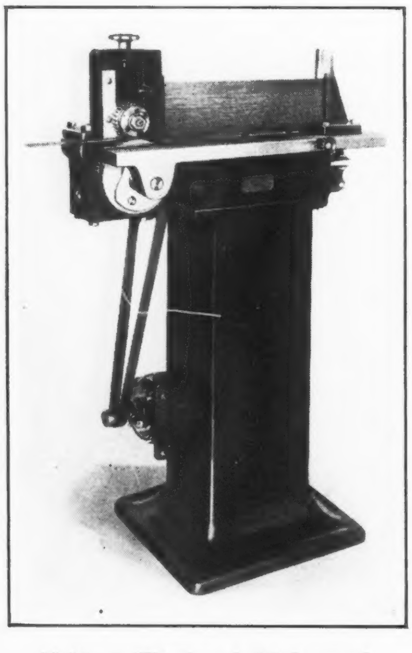


Cutler-Hammer Dust-tight Starter Case

A soft rubber gasket is provided between the cover and the case. Eyebolts with wing-nuts at the sides hold the cover tight. In addition to being dust-tight, the small cast-iron enclosure is also weatherproof. It has the start, stop, and reset buttons mounted directly in the cover. In the larger sizes, the reset button only is in the cover, and a separate dust-tight push-button station provides remote control.

NOBLE & WESTBROOK MARKING MACHINE

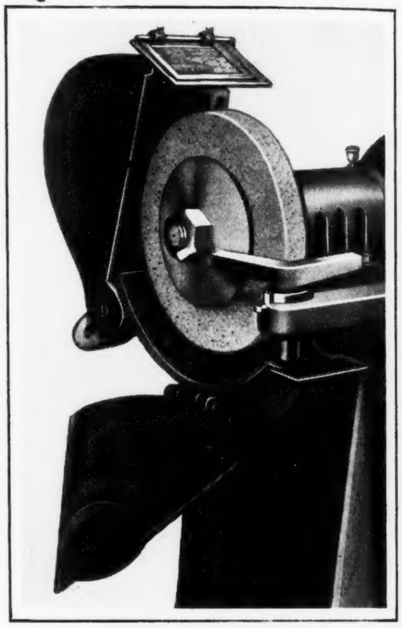
Guards for safety razors are trademarked and marked "Made in U. S. A." at high speed in a recent adaptation of the "Rapid Production" marking machine built by the Noble & Westbrook Mfg. Co., 20 Westbrook St., East Hartford, Conn. Metal strips which are afterward cut into ten pieces are run through the machine and marked at the rate of 40 strips, or 400 pieces, per minute. The machine is fed by hand, and one operator can keep two machines supplied because the strips are carried along automatically and all the operator has to do is to keep the magazine filled.


Noble & Westbrook High-speed Marking Machine

The feeding mechanism is operated by a cam, and is so timed that the bottom strip in the magazine passes under the marking die as soon as the preceding strip leaves it. The die is in the form of a roll 2 1/2 inches in diameter. This machine is driven by a 1/4-horsepower motor.

IMPROVED GRINDING WHEEL GUARD

Heavy-duty grinders built by the United States Electrical Tool Co., 2477 W. 6th St., Cincinnati, Ohio, are now equipped with a new wheel guard of the type illustrated. This guard has a hinged door which is adjustable to compensate for wheel wear, but when adjustments are made, the exhaust connections remain stationary.

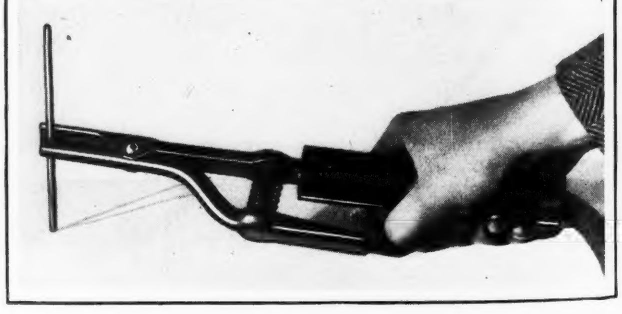

Improved Wheel Guard for U. S. Heavy-duty Grinders

The upper section and lower sections of the guard are separate pieces, and the upper section may be adjusted backward to compensate for wear of the wheel by loosening a screw. In changing the wheel, the hood is simply lifted up and the hinged door is permitted to drop down.

WESTINGHOUSE METAL ELECTRODE-HOLDER

A light weight metal holder recently brought out by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., to take all commercial sizes of arc welding electrodes up to and including 1/4 inch is shown in the accompanying illustration.

The jaws of this holder are pressed-metal parts constructed to grip the electrode in any position or at any angle. The close distance between the lower jaw and the upper handle enables the holder to be used in crowded places. The holder is furnished

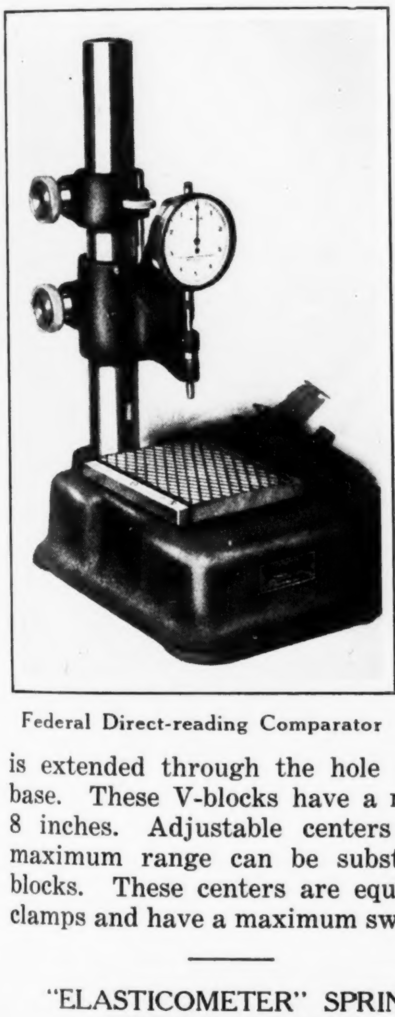

Westinghouse Light-weight Electrode-holder

with or without 5 feet of attached flexible cable. Without this cable the holder weighs approximately 18 ounces.

For light carbon electrode welding or cutting, an adapter which handles 3/8- and 1/2-inch carbon rods can be furnished for use with the holder.

FEDERAL DIRECT-READING COMPARATOR

The latest addition to the line of precision measuring instruments made by the Federal Products Corporation, 1144 Eddy St., Providence, R. I., consists of the dial-equipped comparator here illustrated. The dial of this instrument is graduated to 0.0001 inch, and as each graduation is 1/10 inch apart, close readings can be obtained with ease. An adjustable device can be attached to the dial to form a vee from the edge of the dial to the center, with only the graduations exposed that represent the plus and minus limits of dimensions to be checked. This device expedites inspection, because if the needle does not appear within the vee in checking a part, the operator immediately knows that the measurement is not within the limits specified.



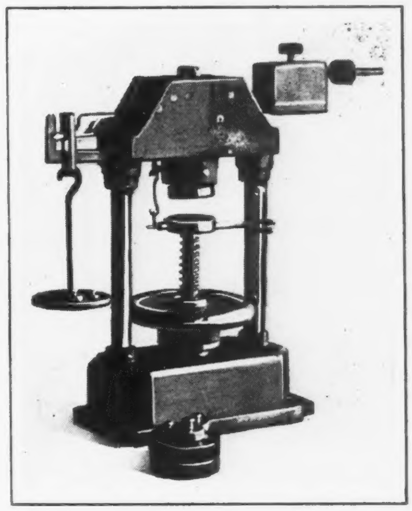
Federal Direct-reading Comparator

This comparator can be equipped with roller type V-blocks supported by brackets mounted on a round bar which is extended through the hole in the comparator base. These V-blocks have a maximum range of 8 inches. Adjustable centers having the same maximum range can be substituted for the V-blocks. These centers are equipped with locking clamps and have a maximum swing of 3 3/4 inches.

"ELASTICOMETER" SPRING TESTING MACHINE

An "Elasticometer" designed for testing highly sensitive tension and compression springs is being introduced on the United States market by the Coats Machine Tool Co., Inc., 110-112 W. 40th St., New York City. Loads ranging from 1/5 ounce to 56 pounds may be determined with this type R-25 instrument. It represents an addition to the "Elasticometers" described in MACHINERY for June, 1927, page 799, and January, 1929, page 393, which are intended for loads up to 180 pounds and 2240 pounds, respectively.

The weighing mechanism of the new instrument is located in the upper housing, and has a 1 to 10 leverage. Compression springs to be tested are placed between two plates, the lower of which is actuated through a screw and handwheel located on the lower housing. At the left of the upper compression plate there is a hook to which tension springs are attached for testing. The strength of springs is determined by placing loose weights on the hook of the weight beam. The scale attached to the right-hand supporting pillar is graduated to 1/32 inch and indicates the length of springs, both open and compressed. Tolerance markers may be arranged beside this scale to facilitate quantity inspection.



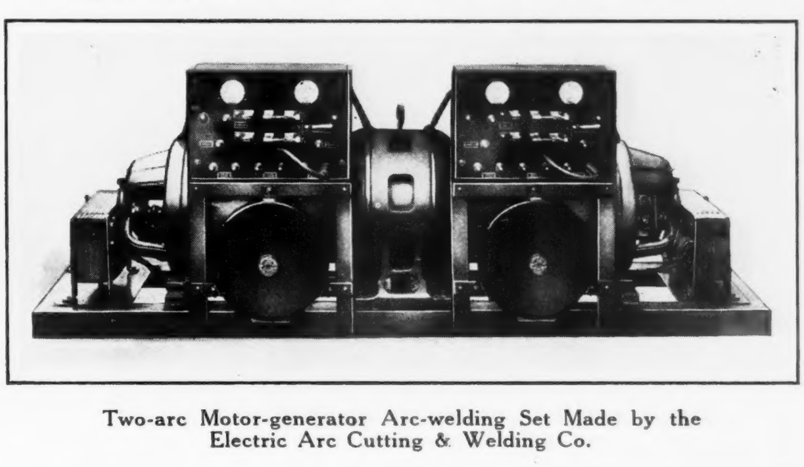
"Elasticometer" for Loads from 1/5 Ounce to 56 Pounds

Centering or guide pins may be inserted in the lower compression plate to prevent small compression springs from buckling over. The upper compression plate is bored to receive these pins. The slidable weight on the upper right-hand side of the device, together with its fine adjustment screw, is used for balancing the machine both before and after the load is applied.

The maximum distance between compression plates and tension hooks is 4 inches. Springs up to a maximum diameter of approximately 2 3/8 inches can be handled. The net weight of the machine is about 45 pounds.

TWO-ARC MOTOR-GENERATOR APPARATUS

In a two-generator set recently placed on the market by the Electric Arc Cutting & Welding Co., 152-156 Jelliff Ave., Newark, N. J., for use in arc-



Two-arc Motor-generator Arc-welding Set Made by the Electric Arc Cutting & Welding Co.

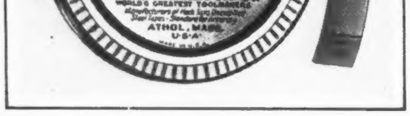
welding operations, an electric motor located between the generators is employed for driving them. These generators may be run in series so as to obtain the high voltage required for cutting, for carbon arc welding, or for heavy bronze welding. They are so arranged as to share the load equally. It is pointed out by the manufacturer that while it may be thought that any two similar generators can be run in multiple if the proper leads are placed together, such is not the case, because differences in the regulation of self-regulated generators require them to be paired if they are to share the load, and even then, they do not always remain parallel.

When the two generators of this equipment are run in multiple, the current from the armature of generator No. 1 goes through the series field of No. 2, and the armature current of No. 2 goes through the series field of No. 1. This cross connection prevents one generator from "hogging" the load. This field cross connection scheme is also used on the shunt fields to steady the paralleling action in some cases, but the interpole field is never changed or reversed, each generator holding its polarity and good commutation thereby.

Independent control and adjustment are two advantages claimed for the apparatus, and only one-half the power consumption by either generator when they are run separately or alone. Patents are pending on this new development.

STARRETT THICKNESS-GAGE STOCK IN ROLLS

Thickness-gage or feeler stock has recently been placed on the market in rolls by the L. S. Starrett Co., Athol, Mass., for use in production operations where thickness gages are constantly employed. This No. 666 thickness-gage stock comes in 25-foot rolls 1/2 inch wide and in thicknesses from 0.0015 to 0.015 inch. Each roll is packed in a dirt-protecting metal case as shown.



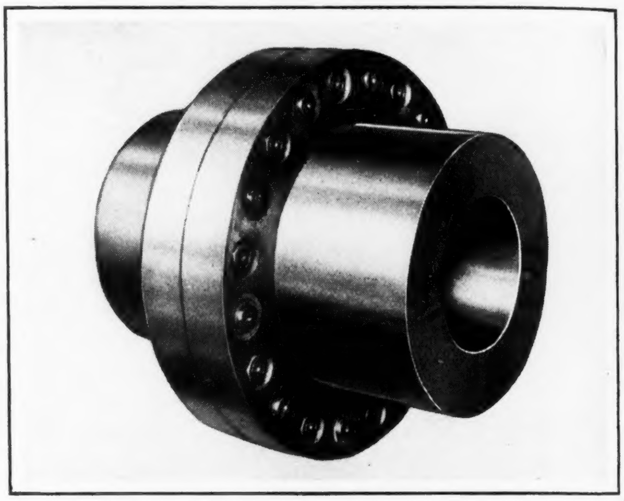
Starrett Thickness-gage or Feeler Stock

This stock is spring tempered and is marked every 6 inches with a line and the thickness dimension, which permits accurate cutting to length and eliminates waste. There is the advantage with this stock roll that if a feeler becomes bent or kinked from use, the damaged section can be quickly cut off to make a new piece immediately available.

When used in the Starrett thickness-gage holder No. 806, the last bit of stock can be used and there is no danger of the fingers being cut. This holder takes stock of any thickness from 0.0015 to 0.025 inch.

AJAX FLEXIBLE COUPLING WEIGHING 2000 POUNDS

A rubber-bumper flexible coupling weighing 2000 pounds was recently made by the Ajax Flexible Coupling Co., Westfield, N. Y., for installation between a water wheel and a speed increaser at the Hudson River Mill of the International Paper Co., Corinth, N. Y. This 9 1/2-A coupling, which is


Flexible Coupling which Transmits 1200 Horsepower at 220 Revolutions per Minute

here illustrated, was designed to transmit 750 horsepower at 1000 revolutions per minute, but in the particular installation in which it is to be used, 1200 horsepower will be transmitted at 220 revolutions per minute. The coupling is 28 inches outside diameter, 27 1/4 inches over-all length, and was bored in the shop of the manufacturer to a diameter of 10 inches. It is to be rebored to a larger size by the user. Power is transmitted through twenty drive studs 1 1/4 inches in diameter.

* * *

NON-GLARE GLASS FACILITATES OBSERVATION OF ELECTRICAL INSTRUMENTS

Switchboard instruments manufactured by the General Electric Co., Schenectady, N. Y., such as ammeters, voltmeters, and wattmeters, are now provided with a special glass which, in combination with anti-parallax scales and pointers, facilitates reading of the instruments regardless of the angle from which they are viewed. Instruments of this new line are uniform in size and appearance for both alternating and direct current. The instruments are 6 inches high, 5 1/2 inches wide, and 3 1/2 inches deep. Four instruments can be mounted across a 24-inch switchboard panel.

* * *

The Department of Commerce announces that according to data collected by the department, the total production of tractors in 1928 numbered 171,137, valued at $161,461,500. Of this total, 152,124 tractors, valued at $113,730,500, were of the wheeled type, and 19,013 valued at $46,731,000 were of the caterpillar or tracklaying type. Nearly 50,000 tractors were exported. Twenty-six manufacturers made the wheeled type of tractors, and five the caterpillar or tracklaying type.

THE MACHINE TOOL EXPOSITION IN CLEVELAND

The Second National Exposition of Machine Tools and Shop Equipment held under the management of the National Machine Tool Builders' Association will be staged in Cleveland September 30 to October 4. The exposition will occupy a somewhat greater area than did the first national machine tool exposition, held in the Public Auditorium Buildings in Cleveland in 1927. The list of exhibitors includes 239 companies.

The exhibits will comprise machine tools, small metal-cutting tools, supplies, materials, and accessories for machine shop use. Almost all the machinery exhibits will be operating under power.

The exposition is not intended for the general public, but all executives in the machinery industries, buyers of shop equipment, machine tool users, engineers, and directors and important stockholders of industrial companies are invited to attend. In conjunction with the exposition, there will be sessions of the Machine Tool Congress, a program for which will be issued later. The Society of Automotive Engineers will also hold its production meeting in Cleveland during the exposition, and the Machine Shop Practice Division of the American Society of Mechanical Engineers will hold its annual shop practice meeting at the same time.

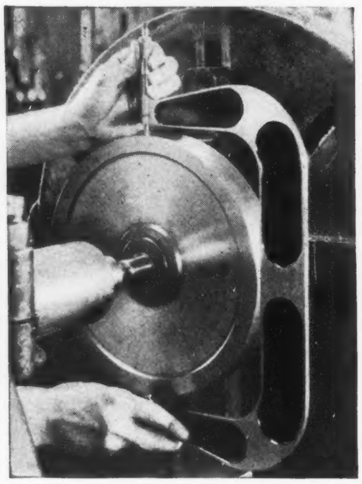
A list of the exhibitors follows:

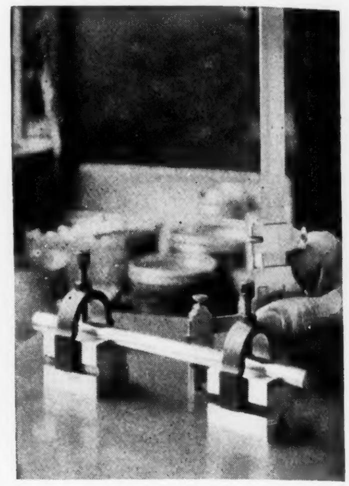
Abrasive Machine Tool Co.
Acme Machinery Co.
Acme Machine Tool Co.
Ahlberg Bearing Co.
Charles G. Allen Co.
Allis-Chalmers Mfg. Co.
American Broach & Machine Co.
American Machinist
American Tool Works Co.
Anderson Bros. Mfg. Co.
Armstrong-Blum Mfg. Co.
Armstrong Bros. Tool Co.
Arter Grinding Machine Co.
Associated Machine Tool Dealers
E. C. Atkins & Co.
Automatic Nut-Thread Corporation
Automotive Industries
Avey Drilling Machine Co.
Baker Bros., Inc.
Baker-Raulang Co.
Barber-Colman Co.
W. F. & John Barnes Co.
Barnes Drill Co.
Leon J. Barrett Co.
John Bath & Co., Inc.
Bausch & Lomb Optical Co.
Charles H. Besly & Co.
Biax Flexible Shaft Co.
Black & Decker Mfg. Co.
G. S. Blakeslee & Co.
Blanchard Machine Co.
J. G. Blount Co.
Bowen Products Corporation
Boye & Emmes Machine Tool Co.
Bradford Machine Tool Co.
Bridgeport Safety Emery Wheel Co.
Brown & Sharpe Mfg. Co.
Bryant Chucking Grinder Co.
Buffalo Forge Co.
Buckeye Portable Tool Co.
Buhr Machine Tool Co.
Bullard Co.
Canadian Machinery and Manufacturing News
Canedy-Otto Mfg. Co.
Carboloy Co., Inc., (with General Electric Co.)
Carlton Machine Tool Co.
Chicago Belting Co.
Chisholm-Moore Hoist Corporation
Cincinnati Bickford Tool Co.
Cincinnati Grinders, Inc.
Cincinnati Lathe & Tool Co.
Cincinnati Milling Machine Co.
Cincinnati Shaper Co.
Cisco Machine Tool Co.
Cleveland Automatic Machine Co.
Cleveland Planer Co.
Cleveland Twist Drill Co.
Cochrane-Bly Co.
Colonial Tool Co. (with Michigan Tool Co.)
Columbia Machine Tool Co.
Conradson Tool Corporation
Consolidated Machine Tool Corporation of America
Covel-Hanchett Co.
Cushman Chuck Co.
Cutler-Hammer, Inc.
DeWalt Products Corporation
Diamond Machine Co.
Henry Disston & Sons, Inc.
Dreses Machine Tool Co.
Eastern Machine Screw Corporation
Eclipse Interchangeable Counterbore Co.
Economy Engineering Co.
Elwell-Parker Electric Co.
Ex-Cell-O Tool & Mfg. Co.
Fafnir Bearing Co.
Fairbanks, Morse & Co.
Farrel-Birmingham Co., Inc.
Fellows Gear Shaper Co.
Flather Co.
Foley Saw Tool Co.
Foote-Burt Co.
Fosdick Machine Tool Co.
Foster Machine Co.
Frew Machine Co.
Gairing Tool Co.
Gallmeyer & Livingston Co.
Gardner Machine Co.
W. Gaterman Mfg. Co.
Gears & Forgings, Inc.
Geometric Tool Co.
Giddings & Lewis Machine Tool Co.
Gisholt Machine Co.
Gits Bros. Mfg. Co.
Gleason Works
Goddard & Goddard Co., Inc.
Goss & DeLeeuw Machine Co.
Gould & Eberhardt
Greenfield Tap & Die Corporation
Greenlee Bros. & Co.
Hall Planetary Co.
Hammond Mfg. Co.
Hanna Engineering Works
Hannifin Mfg. Co.
Hardinge Bros., Inc.
Hanson-Whitney Machine Co.
Heald Machine Co.
Hendey Machine Co.
Henry & Wright Mfg. Co.
Higley Machine Co.
Hill-Curtis Co.
Hisey-Wolf Machine Co.
Hitchcock Publishing Co.
Hoefer Mfg. Co., Inc.
Hyatt Roller Bearing Co.
Hydraulic Press Mfg. Co.
Illinois Tool Works
Ingersoll Milling Machine Co.
International Machine Tool Co.
Iron Age
Iron Trade Review
Chas. L. Jarvis Co.
Jones & Lamson Machine Co.
Kane & Roach, Inc.
Kearney & Trecker Corporation
Keller Mechanical Engineering Corporation
Kelly Reamer Co.
Kempsmith Mfg. Co.
Kent Machine Co.
Keystone Lubricating Co.
King Machine Tool Co.
Kingsbury Machine Tool Corporation
W. B. Knight Machinery Co.
William Laidlaw, Inc.
Landis Machine Co.
Landis Tool Co.
J. N. Lapointe Co.
LaSalle Tool Co.
R. K. LeBlond Machine Tool Co.
Lees-Bradner Co.
Lehmann Machine Co.
Leland-Gifford Co.
Lincoln Electric Co.
Link-Belt Co.
Lodge & Shipley Machine Tool Co.
Logansport Machine Co.
Lucas Machine Tool Co.
Ludlum Steel Co.
MACHINERY
Madison-Kipp Corporation
Manning, Maxwell & Moore, Inc.
Marlin-Rockwell Corporation
Marschke Mfg. Co.
McCrosky Tool Corporation
Mill and Factory Illustrated
Modern Machine Shop
Modern Machine Tool Co.
Moline Tool Co.
Monarch Machine Tool Co.
Morse Chain Co.
Morton Mfg. Co.
Murchey Machine & Tool Co.
National Acme Co.
National Automatic Tool Co.
National Machinery Co.
National Twist Drill & Tool Co.
New Britain-Gridley Machine Co.
New Departure Mfg. Co.
Niagara Machine & Tool Works
Niles-Bement-Pond Co.
Noble & Westbrook Mfg. Co.
Norma-Hoffmann Bearings Corporation
Norton Co.
Oakite Products, Inc.
Oesterlein Machine Co.
Ohio Machine Tool Co.
Oilgear Co.
O. K. Tool Co.
Oliver Instrument Co.
Oster Mfg. Co.
Peerless Machine Co.
Porter-Cable Machine Co.
Potter & Johnston Machine Co.
Pratt & Whitney Co.
Producto Machine Co.
Thomas Prosser & Son
Q-C Engineering & Tool Sales, Inc.
Racine Tool & Machine Co.
Ramsey Chain Co., Inc.
Reed-Prentice Corporation
Reliance Electric & Engineering Co.
Rickert-Shafer Co.
Rivett Lathe & Grinder Corporation
Rockford Drilling Machine Co.
Rockford Machine Tool Co.
Ross Mfg. Co.
Rotor Air Tool Co.
Joseph T. Ryerson & Son, Inc.
Safety Grinding Wheel & Machine Co.
William Sellers & Co.
Seneca Falls Machine Co.
Sidney Machine Tool Co.
Siewek Tool & Die Co.
Simonds Saw & Steel Co.
S K F Industries, Inc.
Skinner Chuck Co.
Sleeper & Hartley, Inc.
Smith & Mills Co.
Springfield Machine Tool Co.
Standard Electrical Tool Co.
Standard Steel Specialty Co.
Standard Tool Co.
L. S. Starrett Co.
Stockbridge Machine Co.
D. A. Stuart Co.
Sundstrand Machine Tool Co.
Sun Oil Co.
Superior Machine Tool Co.
Swift Welder Co.
Taft-Peirce Mfg. Co.
Taylor & Fenn Co.
Thompson Grinder Co.
Timken Roller Bearing Co.
Titeflex Metal Hose Co.
Torrington Co.
Tuthill Pump Co.
Union Mfg. Co.
Universal Boring Machine Co.
U. S. Electrical Tool Co.
Van Dorn Electric Tool Co.
Van Norman Machine Tool Co.
Walcott Machine Co.
O. S. Walker Co.
Warner & Swasey Co.
Westinghouse Electric & Mfg. Co.
Whitney Metal Tool Co.
Whitney Mfg. Co.
Williams Tool Corporation
Wisconsin Electric Co.
Yale & Towne Mfg. Co.

* * *

During the past year the freight originating from the automotive industry and carried by the railroads of the United States amounted to more than 3,500,000 car loads.

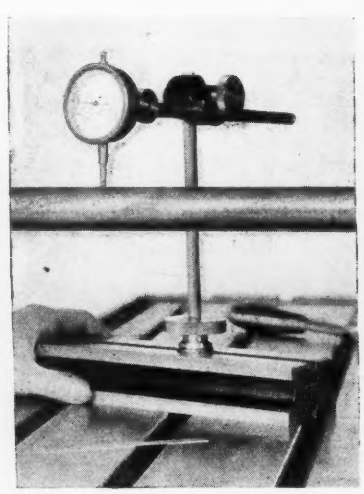
SKILLED HANDS
DO BETTER and FASTER





TRAINING makes a man a skilled machinist; good tools make it possible for him to apply his skill to useful work.

Good workmen the world over choose Brown & Sharpe Tools because the accuracy, simplicity, and lasting quality of the tools help them to do consistently better and faster work. For nearly 80 years these tools have been recognized as the standard of comparison.



For the BEST WORK – choose

B·S

OBITUARIES

JOSEPH N. LAPOINTE

Joseph N. Lapointe, founder of the J. N. Lapointe Co., New London, Conn., and one of the pioneer manufacturers of broaching machines, was stricken by a heart attack while attending a performance at the Garde Theater, New London, on May 4, and died almost immediately. His death came as a great shock to his family and many friends.

Mr. Lapointe was born in St. Hyacinthe, a suburb of Montreal, Canada, on March 31, 1861. He remained in St. Hyacinthe until he was seventeen years old and had acquired an elementary education.

In 1878, his parents removed to Waterbury, Conn., where he continued his education in the public schools. He entered the employ of the Benedict Brass Mfg. Co.'s plant in Waterbury as an apprentice in the machinist's trade, and became so skilled a workman that before he passed his eighteenth year he was foreman of a department of the Waterbury Watch Co. For seven years he was connected with this company. When he was twenty-five, he became connected with the Seth Thomas Watch Co., and during his association with that company he invented several devices upon which patents were issued, one for an automatic rotary pinion and the other for a polishing machine.

At the age of twenty-eight, he left the Seth Thomas Co. and opened a small machine shop in Waterbury, which he later sold. He then went with the Pratt & Whitney Co. of Hartford. During his fourteen years of association with this concern, his inventive genius was given full rein, and he perfected and made many improvements in manufacturing both tools and toolmaking machinery. It was at this time that he devised and inaugurated the Lapointe broaching system now in general use.

From the Pratt & Whitney Co. Mr. Lapointe went to the Becker Milling Machine Co. at Hyde Park, Mass. After spending three years with that company, he again went into business for himself at Boston, where he perfected a broaching machine of his own design. His first order came from the Mason Regulator Works of Milton, Mass., and his second, from an automobile manufacturing company in France. In 1902, Mr. Lapointe visited France and received orders for broaching machines to the amount of $18,000 from automobile manufacturers.

In 1906, he established the Lapointe Machine Tool Co. and built a plant at Hudson, Mass. Five years later he severed his connection with that company and organized the J. N. Lapointe Co. in Marlboro, Mass., for manufacturing broaching machines. In 1913, the company moved to New London, Conn., and erected a modern plant. In 1919, Mr. Lapointe sold this business, and the following year bought the Arnold Electric Tool Co. of New Haven, which he removed to New London, Conn., where he began the manufacture of portable electric drills. Later, he became interested in real estate. He is survived by his wife, three sons, and one daughter.

FRANK BURGESS

Frank Burgess, president of the Boston Gear Works, Norfolk Downs, Quincy, Mass., died at his home in Wollaston, Mass., on May 18, aged sixty-nine years. Mr. Burgess was born in Natick, Mass., April 25, 1860, and received his education in the schools of Boston, graduating from high school in 1878. He became gymnasium instructor of the Detroit Y. M. C. A. in 1879, and was greatly interested in Y. M. C. A. work throughout his life. From 1914 to 1917 he served as president of the Board of Directors of the Quincy Y. M. C. A., and was also on the Y. M. C. A. State Committee of Massachusetts and Rhode Island.

After spending one year as gymnasium instructor in Detroit, he became connected with the Union Switch & Signal Co., and later with the Gamewell Fire Alarm Co. of Newton, Mass. In 1890 he went to work for George B. Grant, founder of the Boston Gear Works, and the following year purchased the company, which has since developed into one of the largest gear manufacturing concerns in the country, having a plant at Norfolk Downs, Mass., and stores at Boston, Chicago, Cleveland, Philadelphia, and New York.

Mr. Burgess was a member of the American Gear Manufacturers' Association, the Society of Automotive Engineers, and the National Metal Trades Association.

Edmund Perkins Edwards, manager of the radio department of the General Electric Co. since its organization in 1921, died at his home in Schenectady on April 27, following an illness of nearly a year. Mr. Edwards graduated from the Rose Polytechnic Institute in 1899 with the degree of Bachelor of Science in electrical engineering, and in the same year entered the employ of the General Electric Co. In 1906 he was transferred to the lighting department, later becoming assistant manager of the department. He was active in the early commercial activities relative to radio apparatus, and in 1921, when the radio department was organized, he was made manager of that department, in charge of commercial, engineering, and manufacturing activities. Mr. Edwards was a member of numerous engineering and technical associations.

L. Glen Hewins

L. Glen Hewins, sales manager of Gears & Forgings, Inc., Cleveland, Ohio, and his wife were killed May 8 when their automobile was struck by an express train, on the Pennsylvania Railroad, at a crossing south of Newcastle, Ind. Mr. Hewins had been associated with the company and one of its predecessors for fourteen years. At the time of the accident, he was on a business trip. He was a graduate of Dennison University, Granville, Ohio. Being interested in industrial marketing, he had devoted much of his time to work among clubs sponsoring this movement.

PERSONALS

A. E. Thornton was elected assistant treasurer of the Skinner Chuck Co., New Britain, Conn., at a recent meeting of the board of directors.

L. G. Tandberg has been appointed branch manager of the Los Angeles sales office, 1220 S. Hope St., Los Angeles, Calif., of the Wagner Electric Corporation, St. Louis, Mo.

J. H. Tredinnick, for nine years with the Lanston Monotype Co., Philadelphia, Pa., in charge of matrix production, has joined the V & O Press Co., Hudson, N. Y., in the capacity of factory manager.

Everett N. Case and L. W. Mosher have been elected assistant secretaries of the General Electric Co., Schenectady, N. Y. Both these men are in the New York executive offices of the company.

Charles Strom, formerly with the Fiske Tire & Rubber Co., has joined the export sales department of the Black & Decker Mfg. Co., and after a short stay in the factory at Towson, Md., will represent the company in foreign markets.

John McC. Price has been appointed district manager in charge of the Chicago office, 500 N. Dearborn St., of the Allen-Bradley Co., Milwaukee, Wis. Mr. Price was formerly district manager for the Industrial Controller Co. in the same territory.

R. S. Arthur, formerly in charge of the Chicago office of the Dravo Equipment Co., has been appointed manager of the Midwestern branch office recently opened by the Aeroil Burner Co. of West New York, N. J., at 176 N. Wacker Drive, Chicago.

John F. Guider, for twenty-three years production engineer of the Pierce-Arrow Motor Car Co., Buffalo, N. Y., has joined the newly incorporated organization of the J. L. Osgood Machinery & Tool Co., Inc., 43-45 Pearl St., Buffalo, N. Y., as sales manager.

Frank R. Williams has been added to the sales force of Gears and Forgings, Inc., Cleveland, Ohio, at the Buffalo office. Mr. Williams has spent many years in the power transmission field, and will devote much of his time to the speed reducer line of the company.

H. B. SPACKMAN has resigned as vice-president and purchasing agent of the Lukens Steel Co., Coatesville, Pa., and has been elected chairman of the executive committee of the board of directors. HUGH KENWORTHY, formerly assistant purchasing agent, has been made purchasing agent.

LOUIS E. MURPHY was elected president of E. F. Houghton & Co., Philadelphia, Pa., at a special meeting of the board of directors, succeeding the late Charles E. Carpenter. A. E. CARPENTER was elected first vice-president and treasurer, and GEORGE W. PRESSELL, second vice-president and secretary.

MARCUS T. LOTHROP was elected president of the Timken Roller Bearing Co., Canton, Ohio, at a recent meeting of the board of directors, succeeding H. H. TIMKEN, who becomes chairman of the board. Other officers elected were W. R. TIMKEN, J. G. OBERMIER, J. W. SPRAY, T. V. BUCKWALTER, and H. J. PORTER, vice-presidents, and J. F. STROUGH, secretary-treasurer. Judd W. Spray was also elected a director. All the previous members of the board of directors were re-elected, and A. C. ERNST was added to the board. Mr. Lothrop became connected with the company in 1911 as metallurgist. Since that time he has occupied various capacities in metallurgy, research, in charge of operations, and for the last few years has served as vice-president and general manager in charge of all operating and sales. Mr. Spray has been with the company for fourteen years in various capacities, having been Detroit sales manager up to 1926, when he was made general sales manager. In 1928 he was made vice-president in charge of sales.


© Bachrach
Marcus T. Lothrop

A. A. OSSWALD, for the last three years connected with the Cleveland Punch & Shear Co., Cleveland, Ohio, has joined the V & O Press Co., Hudson, N. Y., as direct factory representative. Mr. Osswald will cover the state of Ohio, and his headquarters will be at 710 Hippodrome Bldg., Cleveland, Ohio.

NEIL CURRIE, JR., managing engineer of the motor department of the Pittsfield Works of the General Electric Co., for the last five years, has been made manager of the Philadelphia Works of the company. ROBERT V. GOOD, section superintendent in the Schenectady Works, has been made assistant to the manager at Philadelphia.

HOMER S. TRECARTIN, formerly sales manager of the Roller Bearing Co. of America, Trenton, N. J., maker of "Heliflex" flexible roller bearings, has been appointed general manager of the company. Mr. Trecartin has specialized in transmission matters, and has been engaged for a long time in that branch of industry, on both sales and engineering.

ROBERT F. ELDER has received the Alvan T. Simonds award of $1000 for the best essay on "Reducing the Costs of Distribution for the Year 1928." Mr. Elder is a graduate of Harvard University and a specialist in marketing research for the Brown Co., Berlin, N. H., and Portland, Me. RAY M. HUDSON, assistant director of the Bureau of Standards, Department of Commerce, Washington, D. C., was given honorable mention.

GEORGE A. GEIB, formerly cost analyses engineer for several national engineering concerns, has been appointed branch manager of the Haynes Corporation, First National Bank Building, Chicago, Ill., industrial engineers. He will represent this company in the St. Paul-Minneapolis territory. Mr. Geib was for several years branch manager for a national distributor of electrical appliances, and more recently has been a member of the engineering staff of the Haynes Corporation.

EDWIN H. PEIRCE, formerly vice-president and general manager of the Niles Tool Works Co., Hamilton, Ohio, has been made vice-president and general manager of the Atwood Machine Co., Stonington, Conn. Mr. Peirce was for many years with the United States Steel Corporation as superintendent of the New Haven Works, and was also superintendent of the South Works, Worcester, Mass., of the American Steel & Wire Co. He is a director of the Atwood Machine Co. and the Niles-Bement-Pond Co.

C. H. CLARK has been appointed merchandising manager of Robbins & Myers, Inc., Springfield, Ohio, manufacturer of electric motors, generators, and fans. Mr. Clark returns to Robbins & Myers after six years with Montgomery, Ward & Co. of Chicago, where he served as assistant to the vice-president in charge of merchandising and as manager of the general merchandise office. Previous to his association with Montgomery, Ward & Co., he was for nine years advertising manager and a member of the general sales committee of Robbins & Myers.

* * *

TRADE NOTES

WELKER MACHINERY CO., INC., has removed its offices from 650 Beaubien St., Detroit, Mich., to 2720 Union Trust Bldg.

WEDGE-LOCK TOOL CO., 549 W. Randolph St., Chicago, Ill., has been formed to engage in the manufacture of multiple-bit tool-holders.

OLIVER MACHINERY CO., Grand Rapids, Mich., announces that its Seattle office and agency will now be conducted by the Perine Machinery Co., Inc., at its new location at First Ave., South, and King Sts., Seattle, Wash.

TOLHURST MACHINE WORKS, Troy, N. Y., manufacturers of centrifugal machinery, have moved their New York office to the Hudson Terminal Building, 30 Church St. William T. Powers will be in charge of the new office.

BROWN INSTRUMENT CO., 4485 Wayne Ave., Philadelphia, Pa., announces that the Pittsburgh office of the company has been moved to larger quarters at 1522 Oliver Building, where increased facilities are available for handling the growing volume of business in this district.

ALLEN-BRADLEY CO., 499 Clinton St., Milwaukee, Wis., manufacturer of electric controlling apparatus, has established a district office in Atlanta, Ga. H. Douglas Stier and G. G. Moore will be in charge of the southern office, which will be located at 101 Marietta St., Atlanta.

NATIONAL TWIST DRILL & TOOL CO., Detroit, Mich., manufacturer of twist drills, milling cutters, reamers, hobs, special tools, etc., has acquired a substantial interest in the Winter Bros. Co., of Wrentham, Mass., manufacturer of taps and dies. No changes are contemplated in the Winter organization.

IDEAL COMMUTATOR DRESSER CO., 1011 Park Ave., Sycamore, Ill., has purchased the BOWLUS BORING MACHINE CO., and is now manufacturing the Bowlus machine in its own plant. The machine has been improved by the inclusion of bronze bearings, and a new special link chain is provided for its operation, which prevents injury to the hands.

LEEDS & NORTHRUP CO., 4901 Stenton Ave., Philadelphia, Pa., has secured 190,000 additional square feet of property adjoining its present plant, including a one-story building of sawtooth roof construction containing approximately 85,000 square feet of additional floor space. The new building will be connected with the present factory by a wing.

J. D. WALLACE & CO., 134 S. California Ave., Chicago, Ill., manufacturers of portable woodworking machinery have taken over the JOHN T. TOWSLEY MFG. CO., of Cincinnati, Ohio, manufacturer of large woodworking machinery and factory trucks. The John T. Towsley Mfg. Co. will continue to be operated under its own name as a division of J. D. Wallace & Co.

QUIGLEY FURNACE SPECIALTIES CO., INC., formerly having offices at 26 Cortlandt St., New York City, announces that the new headquarters and research laboratory of the company now occupy the entire eighth floor of the Lakner Building, 56 W. 45th St., New York. The company has also been enlarging and modernizing its factory facilities for some time.

IDEAL COMMUTATOR DRESSER CO., 1011 Park Ave., Sycamore, Ill., announces that the eastern office and warehouse of the company is now located at 18 Warren St., New York City, where larger warehouse space is available for carrying Ideal commutator resurfacers, motor maintenance equipment, etc. R. W. Becker, eastern division manager, and F. J. Dreyfuss, New York district manager, are in charge of the office.

BROWN INSTRUMENT CO., 4485 Wayne Ave., Philadelphia, Pa., has found it necessary, owing to the rapid growth of its business, to erect an addition to its plant. The addition will

consist of a two-story and basement building and a new central wing of two stories and basement. The new buildings will increase the floor space of the plant about 50 per cent. This is the fourth addition that the company has made to its plant in eight years.

CUTLER-HAMMER, INC., 1203 St. Paul Ave., Milwaukee, Wis., announces the establishment of a warehouse at Cleveland, Ohio, to provide better facilities for serving the company's customers in the East Central states. A complete line of standard motor control equipment and wiring devices will be available for immediate shipment from this point. Sales offices for this district are located in Cleveland, Cincinnati, Buffalo, and Pittsburgh.

W. B. RICHARDS & Co., INC., formerly located at 16 Exchange Place, New York City, have moved into larger quarters at 545 Fifth Ave. The company's activities include developing methods of organization and control in industrial plants, as well as the installation of improved methods of administration for municipal, state, and federal government departments. The staff is a composite one of engineers, accountants, and business analysts.

FOOTE BROS. GEAR & MACHINE Co., 111 N. Canal St., Chicago, Ill., has purchased a new factory in Chicago for the manufacture of flywheel starter gears for all makes and models of American automobiles. Sales will be made direct to the jobbing trade for general distribution and also direct to manufacturers of cars, buses, and trucks. John C. Phelps will be in charge of the division, which will also include the production and sales of IXL silent timing gears.

READING CHAIN & BLOCK CORPORATION, Reading, Pa., manufacturer of material handling equipment, chain blocks, electric hoists, traveling cranes, and monorail systems, advises that in the recent decision by Judge W. H. Kirkpatrick of the United States District Court of Eastern Pennsylvania, the suit of the Cleveland Crane & Engineering Co. against the Reading Chain & Block Corporation, for alleged infringement of patent, has been dismissed by the court.

GODDARD & GODDARD Co., INC., Detroit, Mich., milling cutter engineers and manufacturers, have just broken ground for a new factory and office building of modern construction on the company's 8-acre site on Burt Road, overlooking Rouge Park. The office portion will be of brick, two stories in height, of pleasing architectural design, while the factory will be a one-story brick, steel, and glass construction building with four monitors providing a maximum of daylight. The floor area will total 47,000 square feet.

AMTORG TRADING CORPORATION, 261 Fifth Ave., New York City, announces that a delegation from the Putilov Machine Works at Leningrad, headed by V. F. Grachev, manager of the plant, has returned to the Soviet Union after spending several months in this country purchasing equipment for the tractor division of the plant. Orders valued at $750,000 have been placed with American firms. It is expected that the new machinery will make it possible to increase the annual production of the plant from 2000 to 10,000 tractors.

FOOTE BROS. GEAR & MACHINE Co., Chicago, Ill., has moved its general offices from 215 N. Curtis St., to more commodious quarters at 111 N. Canal St. The new offices comprise one floor of a fifteen-story office building and afford approximately 27,000 square feet of floor space. Larger quarters have been found necessary owing to the increase in the company's business during the last five years and to the acquisition of three companies engaged in the manufacture of tractors and graders during the early part of the year. The factory organization will remain at 215 N. Curtis St.

UNION CARBIDE & CARBON CORPORATION, 30 E. 42nd St., New York City, has moved its Chicago district and central division offices to the new forty-story Carbide & Carbon Building at Michigan Ave. and South Water St., Chicago. The various branches of the company that will be located at the new address are: The Linde Air Products Co.; the Prest-O-Lite Co., Inc.; the Oxweld Acetylene Co.; the Oxweld Railroad Service Co.; the Union Carbide Sales Co.; the Carbide and Carbon Chemicals Corporation; the National Carbon Co., Inc.; the Haynes Stellite Co.; the J. B. Colt Co.; and the Acheson Graphite Co.

TOLEDO SCALE Co., 270 Madison Ave., New York City, announces that the TOLEDO PRECISION DEVICES, INC., has been organized for the purpose of rendering service to manufacturing concerns faced by special problems and needing special precision instruments. The Toledo Scale Co. has been engaged in manufacturing automatic devices and scales for checking quality, as contrasted with quantity, and the design and manufacture of these machines will now be taken over by the new company. The officers of the new company are: H. D. Bennett, president; C. O. Marshall, vice-president and general manager; Carl J. Zinke, secretary; and M. L. Schutzberg, treasurer.

J. L. OSGOOD MACHINERY & TOOL Co., 43-45 Pearl St., Buffalo, N. Y., has recently been incorporated, with a capitalization of $100,000 by J. L. Osgood, who established the business thirty years ago and has conducted it up to the present time. The business will continue to be carried on at the same address 43-45 Pearl St., Buffalo, N. Y. The officers are president, treasurer, and general manager, J. L. Osgood; vice-president and manager of sales, John F. Guider; and secretary, Carl E. Klingelhofer. The company will conduct a mercantile machinery and tool business and will also manufacture a special line of machinery and tools, the same as in the past but on a larger scale.

ECLIPSE INTERCHANGEABLE COUNTERBORE Co., 7410 St. Aubin Ave., Detroit, Mich., has recently broken ground for a two-story addition, of 64 by 115 feet, to its factory. The offices will be moved from the first floor of the present factory to the second floor of the addition, so that all the present office space will be released for manufacturing, and the ground floor of the addition will also be used for the machine shop. It is expected that this addition will give an increase of approximately 75 per cent over the present facilities. Less than two years ago the company increased its manufacturing space about 40 per cent, but the rapid increase in the demand for its products has made another addition necessary.

* * *

STRENGTH AND WEAR OF GEAR TEETH

In an address before the Cincinnati Chapter of the American Society for Steel Treating, E. F. Davis, metallurgist of the Warner Gear Co., Muncie, Ind., called attention to the need for better gear steels that would be freer from impurities. He showed, by examples, the effect of included matter in the gear material in reducing both the life of the cutter by which the teeth are milled and the life of the gear teeth. Not only are such included impurities a source of weakness, but the region surrounding the inclusion is of low strength and the total area affected is often ten to twelve times the area of the inclusion proper. Mr. Davis also illustrated how variations in the tooth profile and bad chamfers and corners at the base of the teeth affect the impact values of gear teeth. He stated that incorrect tooth forms are one of the principal causes of early tooth destruction and also pointed out the advantage of a cyanided surface in preventing the starting of initial pitting.

* * *

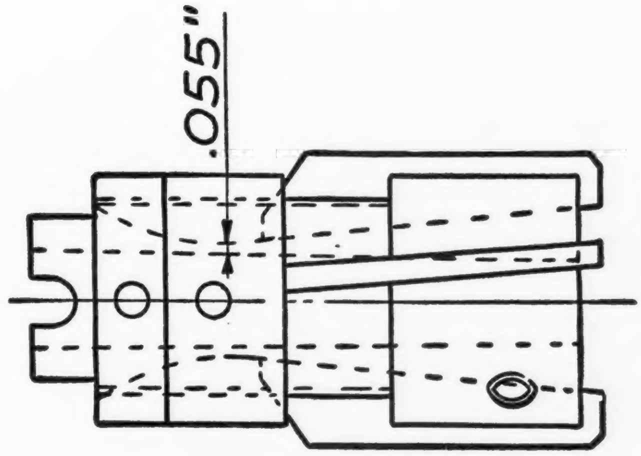
AWARDS TO WORKERS FOR SUGGESTIONS

During 1928, the General Electric Co., Schenectady, N. Y., awarded 5627 of its employes the sum of $62,381 for suggestions tending to improve working conditions in the plants, or increase the efficiency. During the year over 18,000 suggestions were offered, an increase of more than 3000 over the previous year. Of these, about 32 per cent were accepted. The largest award was $1200 given to an employe in the Schenectady Works for his suggestion of means of improving the manufacture of refrigerators.

* * *

PROPOSED STANDARDS FOR SHAFTING AND KEYS

Proposed revisions of the American standards for cold-finished shafting, square and flat stock keys, plain taper stock keys, and gib-head taper stock keys have been recommended by the committee handling this work. Copies of the proposed changes may be obtained by addressing C. B. LePage, assistant secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York City; suggestions and criticisms are invited before the final adoption of these standards.



The thickness of the wall between the hole and the bottom of the blade slot is .055" in this small Wetmore Shell Reamer. In larger sizes where more strength is required, the thickness of the wall is greater.

Why WETMORE REAMERS are strong where ordinary reamers are weak—

You Wouldn't Choose the Doughnut that has the largest hole!

You can't eat the hole—it's the sidewall you want. The larger the hole, the "weaker" the doughnut.

What you want is ample sidewall for more "strength", and not too much hole. It's a far cry from doughnuts to reamers, but you see the point.

JUST as a chain is no stronger than its weakest link—A reamer is no stronger than *its* weakest section.

Study the drawing of a Wetmore Shell Reamer shown above. Note that this reamer is designed with a hole of ample size to give the reamer sufficient strength and at the same time to secure the maximum amount of adjustment oversize.

The thinner the wall, the weaker the reamer. If the wall is built too light in order to obtain a large hole through the reamer, the angle for oversize adjustment is decreased, thereby cutting down the amount of oversize adjustment possible.

Sounds technical perhaps, but when you think about it, it's perfectly obvious. And it proves that Wetmore Reamers are scientifically built to give greatest satisfaction—strength that means long life without grief, maximum possible oversize adjustment that means greater adaptability.

Send now for Wetmore Catalog No. 29, for full information about Wetmore standard, heavy-duty, shell, small machine, and cylinder reamers, arbors, and replacement blades. Sent free, postpaid.

WETMORE REAMER COMPANY
60 27th Street Milwaukee, Wisconsin

WETMORE ADJUSTABLE REAMERS
"THE BETTER REAMER"

COMING EVENTS

JUNE 19-21—International Management Congress to be held at Paris, France. A large delegation from America will attend. For further information, address the American Management Association, 20 Vesey St., New York City.

JUNE 24-27—Second National Oil and Gas Power meeting of the Oil and Gas Power Division of the American Society of Mechanical Engineers at State College, Pa. Further information may be obtained from Professor F. G. Hechler, State College, Pa.

JUNE 24-28—Annual meeting of the American Society for Testing Materials at the Chalfonte-Haddon Hall Hotel, Atlantic City, N. J. C. L. Warwick, Secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

JUNE 25-28—Summer meeting of the Society of Automotive Engineers at Saranac Inn, Saranac Lake, N. Y. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

JULY 1-4—Summer meeting of the American Society of Mechanical Engineers at Salt Lake City, Utah. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

AUGUST 26-28—Aeronautic meeting of the Society of Automotive Engineers at the Hollenden Hotel, Cleveland, Ohio. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

SEPTEMBER 9-11—Fall meeting of the Institute of Metals Division, American Institute of Mining and Metallurgical Engineers in Cleveland, Ohio. W. M. Corse, secretary, 810 Eighteenth St., N.W., Washington, D. C.

SEPTEMBER 9-12—Fall meeting of the American Welding Society in Cleveland, Ohio. M. M. Kelly, secretary, 33 W. 39th St., New York City.

SEPTEMBER 9-12—Fall meeting of the Iron and Steel Division, American Institute of Mining and Metallurgical Engineers in Cleveland, Ohio. H. Foster Bain, secretary, 29 W. 39th St., New York City.

SEPTEMBER 9-13—Annual convention of the American Society for Steel Treating at Cleveland, Ohio. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

SEPTEMBER 9-13—National Metal Congress in Cleveland, Ohio. Simultaneous meetings with the American Welding Society; Institute of Metals Division, American Institute of Mining and Metallurgical Engineers; Iron and Steel Division, American Society of Mechanical Engineers; Iron and Steel Division, American Institute of Mining and Metallurgical Engineers; and American Society for Steel Treating.

SEPTEMBER 9-13—Eleventh National Metal Exposition under the auspices of the American Society for Steel Treating at the Cleveland Public Auditorium, Cleveland, Ohio. For further information, address W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

SEPTEMBER 11-13—Fall meeting of the Iron and Steel Division, American Society of Mechanical Engineers in Cleveland, Ohio. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

SEPTEMBER 30-OCTOBER 4 — Machine Tool Exposition held by the National Machine Tool Builders' Association in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, Provident Bank Building, Cincinnati, Ohio.

OCTOBER 2-4—Production meeting of the Society of Automotive Engineers to be held at Hotel Cleveland, Cleveland, Ohio. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

DECEMBER 2-6—Annual meeting of the American Society of Mechanical Engineers at the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

SOCIETIES, SCHOOLS AND COLLEGES

DREXEL INSTITUTE, Philadelphia, Pa. Catalogue for 1929-1930, containing calendar, outline of courses, etc.

POLYTECHNIC INSTITUTE OF BROOKLYN, Livingston and Court Sts., Brooklyn, N. Y. Seventy-fourth annual catalogue, containing calendar, outline of courses, and other related information.

NEW BOOKS AND PAMPHLETS

OPPORTUNITIES FOR CHEMISTS IN THE UNITED STATES CIVIL SERVICE. 28 pages, 3 1/2 by 8 inches. Published by the United States Civil Service Commission, Washington, D. C. as Form 2528.

OPERATING COST STATISTICS OF AUTOMOBILES AND TRUCKS. By T. R. Agg and H. S. Carter. 51 pages, 6 by 9 inches. Published by the Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa, as Bulletin No. 91 of the Engineering Experiment Station.

THE FAILURE OF PLAIN AND SPIRALLY REINFORCED CONCRETE IN COMPRESSION. By Frank E. Richart, Anton Brandtzaeg, and Rex L. Brown. 74 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 190 of the Engineering Experiment Station. Price, 40 cents.

SIMPLE AERODYNAMICS AND THE AIRPLANE. By Charles N. Monteith. 418 pages, 5 3/4 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $4.50.

This is a completely revised and greatly enlarged edition of a text-book that has been widely used in flying schools, technical schools, and universities to teach the elements of aerodynamics and as an introductory text in engineering colleges that have complete courses in aeronautical engineering. It is also adapted for home study. The material is divided into thirteen chapters dealing with the following subjects: The Airfoil; Criteria for the Selection of Airfoils; Parasite Resistance; The Propeller; The Complete Airplane; Stability; The Control Surfaces; Performance; Dynamic Loads; Materials and Construction; Equipment; Navigation; The Military Airplane. The appendix covers Nomenclature for Aeronautics; Problems in Simple Aerodynamics; Problems in Navigation; and Bibliography.

A HISTORY OF MECHANICAL INVENTIONS. By Abbott Payson Usher. 401 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price, $5.

This book contains a systematic account of the development of the major mechanical inventions from pre-Christian antiquity to modern times. The author is associate professor of Economics at Harvard University, and has written from the viewpoint of the significance of mechanical developments in the analysis of economic history. It is believed, however, that as the interests of the economic historian are merely those of the general reader, this book will have an appeal to engineers and to the general public as well. No attempt has been made to point out the full economic consequences of the technical progress recorded, it having been deemed best to separate the history of the inventions from the discussion of their significance. To those interested in the history of mechanics, this book will undoubtedly be of considerable interest.

NEW CATALOGUES AND CIRCULARS

MANGANESE STEEL. American Manganese Steel Co., Chicago Heights, Ill. Postcard advertising "Amsco" chains made of heat-treated manganese steel.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Loose-leaf bulletin No. 190 FE, descriptive of the application of ball bearings to the rotor shaft of steam turbines.

RADIAL GRINDERS. Mummert-Dixon Co., Hanover, Pa. Loose-leaf catalogue, illustrating and describing Mummert-Dixon portable radial grinders and suspended type radial grinders.

MACHINE SHOP WORK. Peterson Machine Co., Inc., 603 Degraw St., Brooklyn, N. Y. Circular outlining the development, experimental, and production service offered by this company.

MOLDING MACHINES. Tabor Mfg. Co., 6225 Tacony St., Philadelphia, Pa. Bulletins 291, 292, 293, and 294, illustrating and describing the complete line of Tabor foundry molding machines.

ARC-WELDING EQUIPMENT. Lincoln Electric Co., Cleveland, Ohio. Circular illustrating a new twenty-five story building which was connected to an old building by means of arc-welding.

CRANES. Whiting Corporation, Harvey, Ill. Bulletin 188, describing in detail the features of construction of Whiting "Tiger" cranes. General specifications and standard clearances are included.

HEAT-TREATING EQUIPMENT. Stanley P. Rockwell Co., 66 Trumbull St., Hartford, Conn. Bulletin 2904, telling how the Rockwell dilatometer for precision heat-treatment speeds up production.

ELECTRICAL MEASURING APPARATUS. Roller-Smith Co., 233 Broadway, New York City. Bulletin 400, covering the new type FD pyrometer for indicating the temperature of molten type metal.

AUTOMATIC ROLL FEEDS. Wittek Mfg. Co., 2532 S. Kedzie Ave., Chicago, Ill. Bulletin 29F, descriptive of automatic roll feeds for punch presses. Complete instructions for installing these feeds are included.

VARIABLE-SPEED TRANSMISSION. Reeves Pulley Co., Columbus, Ind. Circular announcing a new book entitled "The Modern Need for Infinite Speed Adjustability," which has just been brought out by the company.

MILLING CUTTERS. Goddard & Goddard, 4726 Hastings St., Detroit, Mich. Circular illustrating the application of "Go and Go" milling cutters in the plant of the Bullard Machine Tool Co., and the results obtained.

CORK MACHINERY ISOLATION. Armstrong Cork & Insulation Co., Lancaster, Pa. Circular discussing the use of Armstrong's cork machinery isolation for stopping noise and vibration in the operation of machinery.

LIGHTING EQUIPMENT. Crouse-Hinds Co., Syracuse, N. Y. Bulletins 2127, 2130, and 2132, dealing, respectively, with gasoline service station lighting, flood lighting equipment, and airport and airway lighting equipment.

WELDING ROD. Oxweld Acetylene Co., 30 E. 42nd St., New York City. Booklet entitled "High Test Welding Rod," outlining the reasons for using high test rod, and giving information on how to use this rod to the best advantage.

PORTABLE ELECTRIC TOOLS. Millers Falls Co., Millers Falls, Mass. Catalogue 2, containing data on Millers Falls portable electric tools, including drills, saws, sanders, hammers, screwdrivers, grinders, and wire-wheel brushes.

ASPHALTUM COATING TANKS. H. O. Swoboda, Inc., 3400 Forbes St., Pittsburgh, Pa. Bulletin 160, describing Falcon electrically heated large asphaltum coating tanks used in the manufacture of large pipes, culverts, and similar products.

HEATING DEVICES. General Electric Co., Schenectady, N. Y. Bulletin on GE industrial heating devices, giving data on soldering irons, glue pots, immersion heaters, metal melting pots, heating equipment for ovens, direct heat furnaces, etc.

AJAX

DIE GRIP

THE ends of this hanger forging were produced in one operation on a 3″ Ajax Heavy Duty Upsetting Forging Machine.

Rectangular stock 2¼″ x 3¼″ was used. In one stroke the powerful die grip squeezes the body behind the end down to 1″ thickness and the heading tool comes in and forms the eye end. The heavy block of stock in the middle is afterward drawn out on the hammer so that different lengths of hanger can be produced from the one blank.

This forging illustrates one of the advantages of powerful die grip for displacing stock between the gripper dies, but of more importance is the part that the grip plays in producing uniform and accurate upset forgings.

The powerful Ajax toggle die grip, with pins of liberal dimensions backed up with shoe bearings for the outside surfaces of the links behind the moving die, gives rigidity of grip and durability unequaled by any other construction.

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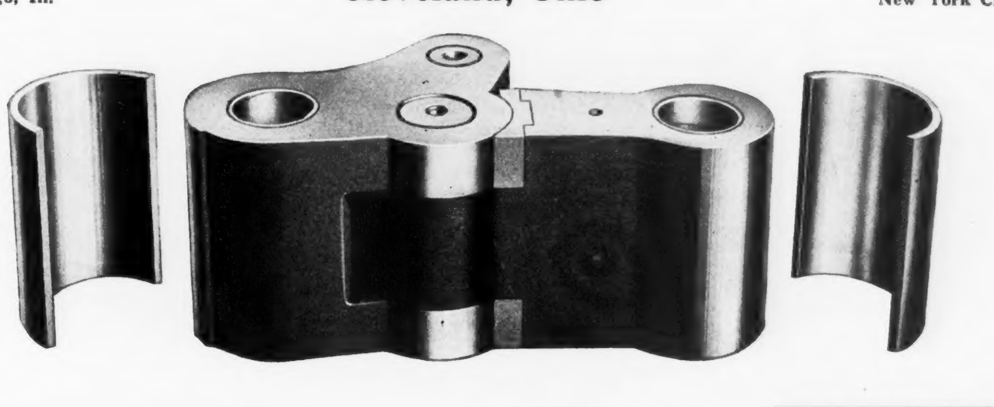

ELECTRIC CONTROLLING APPARATUS. Allen-Bradley Co., 499 Clinton St., Milwaukee, Wis. Bulletin describing the results obtained with the Bulletin 709 electric starter in the engineering department of a large manufacturing plant.

FORGING HAMMERS. C. C. Bradley & Son, Inc., Syracuse, N. Y. Catalogue of Bradley forging hammers, illustrating the various types, as well as examples of work showing the variety of forging and hammering operations that can be performed on these hammers.

TRUCK WHEELS. Divine Brothers Co., Utica, N. Y. Catalogue 22, giving data on Divine canvas cushion caster and truck wheels. In addition to the tabulated dimensions, the pamphlet gives information pertaining to the use of these wheels in practically every industrial truck application.

ELECTRIC WELDING MACHINES. Acme Electric Welder Co., 5621A Pacific Blvd., Los Angeles, Calif. Set of bulletins describing various new types of Acme electric welders and explaining their uses and method of operation and maintenance. Recommendations are given for selecting the proper size of welder to use in particular classes of work.

RIVETS. National Rivet & Mfg. Co., Park Place, Milwaukee, Wis. Rivet display card arranged with metal eyelet for easy mounting, and holding a group of seventeen brass, copper, and aluminum rivets. The rivets displayed are typical standard sizes and types made for automotive, aeronautical, and industrial purposes.

SPROCKETS. Link-Belt Co., 300 W. Pershing Road, Chicago, Ill. Publication 1167, containing 38 pages showing detailed specifications of 15,000 sprocket wheels carried in stock by the Link-Belt Co. These stocks are carried at both Philadelphia and Chicago, and shipments can be made the same day the order is received.

ELECTRIC TRANSFORMERS. Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. Bulletin 164, treating of transformer performance and discussing the losses that occur in distribution and power transformers; method of making tests on transformers; and the calculation of operating characteristics from the test data.

TRUCKS AND PLATFORMS. Lewis-Shepard Co., 171 Walnut St., Watertown Station, Boston, Mass. Circular illustrating the different designs of Lewis-Shepard corrugated, pressed-steel, skid platforms for handling hot materials, heavy loads, and similar work. The bulletin also shows examples of lift trucks and steel storage racks made by this company.

FOUNDRY EQUIPMENT. Link-Belt Co., 300 W. Pershing Road, Chicago, Ill., has just issued three folders of interest to foundrymen, describing, respectively, the continuous malleable foundry of the Saginaw Malleable Iron Division of the General Motors Corporation; the three foundries of the American Manganese Steel Co.; and the Link-Belt vibrating screen.

HARDNESS TESTING DEVICE. Shore Instrument & Mfg. Co., Van Wyck Ave. and Carll St., Jamaica, N. Y. Bulletin M-5, illustrating and describing the application of the "Monotron" Model A hardness indicator. The bulletin contains a paper on the "Monotron" hardness indicator and its work, read by A. F. Shore before the American Society for Steel Treating, Cleveland, Ohio.

MOTOR COMMUTATOR RESURFACERS AND MOTOR MAINTENANCE EQUIPMENT. Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill. Catalogue listing the complete line of commutator and motor maintenance products made by this concern. The catalogue gives information on how to care for equipment at the lowest possible cost and also gives hints on commutator care.

HANDLING AND CONVEYING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Bulletin illustrating the application of the Cleveland tramrail system in the cleaning of metals. Bulletin showing the application of the Cleveland tramrail in handling rolled and flat stock during the processes of manufacture or in transferring it into and out of storage.

TESTING MACHINES. Adam Hilger, Ltd., 24 Rochester Place, London NW-1, England. Bulletin descriptive of Professor Coker's photo-elastic apparatus for determining the distribution of stress in structural and machine members. Catalogue dsecriptive of Professor Coker's lateral extensometer and recording device for the measurement of stress distribution in materials, determination of Poisson's ratio, etc.

POWER TRANSMISSION EQUIPMENT. Diamond Chain & Mfg. Co., 409 Kentucky Ave., Indianapolis, Ind. Booklet 102-A, entitled "Reducing the Cost of Power Transmission." This pamphlet discusses modern engineering practice in power drives, and explains how roller bearing action has been applied to power transmission, with a saving in power and maintenance costs. Many typical installations are described and illustrated.

GRINDING WHEELS. Abrasive Co., Tacony and Fraley Sts., Philadelphia, Pa. Catalogue covering the line of abrasive grinding wheels made by this company. Considerable general information is given on the selection and use of wheels for various classes of grinding, and complete tables for the selection of wheels for operations on a wide variety of materials is included. One section of the book gives standard shapes and sizes of grinding wheels.

ELECTRIC MOTORS. Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. Bulletin 163, descriptive of Wagner type RAR rubber-mounted motors, which are made in ratings of 1/6, 1/4, and 1/3 horsepower. Bulletin 151, third revision, on air-jacketed motors, containing a discussion of dust, fume, and moisture problems requiring special protection for motor and property. The bulletin points out the construction features that make Wagner air-jacketed motors dustproof, fume-proof, and moisture-proof.

ELECTRIC EQUIPMENT. Westinghouse Electric & Mfg. Co., Pittsburgh, Pa. Leaflet L1150-C, on high-speed synchronous motors for use in coupled, belted, or geared service. Leaflet 20403, descriptive of reversing linestarters for squirrel-cage induction motors. Special publication 1836, entitled "The New Deion Circuit-Breaker." This publication consists of a series of A. I. E. E. papers and articles which have appeared in the technical press covering the theory and development of the deion circuit-breaker, and field tests which have been applied to it.

MACHINERY AND TOOLS. Brown & Sharpe Mfg. Co., Providence, R. I. General catalogue 139, covering the complete line of machinery and tools made by this concern, including milling, grinding, gear cutting and hobbing machines, screw machines, and attachments, as well as tools, arbors, cutters, etc. This catalogue is designed primarily for distribution to purchasing agents and shop men who are interested in machinery and machine equipment. It contains illustrations and complete specifications of the various machines and tools, and is provided with an index for convenient reference. The company is also distributing a small tool catalogue, No. 31, for those who are interested primarily in machinists' tools. This lists tools, arbors, cutters, etc.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletins 517B, 588B, 750A, 926A, 966A, 1095, 1106, and 1115, illustrating and describing, respectively, type CD totally enclosed fast-cooled, direct-current motors; centrifugal compressors; induction frequency converters; oil circuit-breakers; metal-clad switch gears; ground clamps for outdoor stations; magnetic switches; and electric furnaces for vitreous enameling. Bulletins GEA-37D, 67A, 181A, 212A, 594A, 788A, 801A, and 1114, illustrating and describing, respectively, direct-heat electric furnaces; float switches for use with automatic pumping equipments; enclosed magnetic switches for alternating-current motors; air circuit breakers; automatic control panels for industrial electric heating; type FT general-purpose squirrel-cage motors; electrically-heated tempering baths; and solenoid-operated valves for the remote control of liquids and gases under pressure.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

of MACHINERY, published monthly at New York, N. Y. for April, 1929.

State of New York }
County of New York } ss.

Before me, a Notary Public, in and for the state and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the treasurer of the Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 140-148 Lafayette St., New York; Editor, Erik Oberg, 140-148 Lafayette St., New York; Managing Editor, None; Business Managers, Alexander Luchars, President, 140-148 Lafayette St., New York, Robert B. Luchars, Vice-president, 140-148 Lafayette St., New York, and Edgar A. Becker, Treasurer, 140-148 Lafayette St., New York.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press; Alexander Luchars; Alexander Luchars, Trustee for Helen L. Ketchum, Elizabeth Y. Urban, and Robert B. Luchars; Nellie I. O'Neill; Louis Pelletier; and Erik Oberg. The address of all the foregoing is 140-148 Lafayette St., New York.

3. That there are no bondholders, mortgagees, or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 19th day of March, 1929.

CHARLES P. ABEL,
Notary Public, Kings County No. 231
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(My commission expires March 30, 1929.)